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John Louch

A

GENERAL TREATISE

OF

ARCHITECTURE.

In FIVE BOOKS.

BOOK I.

By way of Preparative, contains several Rules and Examples both in *Vulgar* and *Decimal* ARITHMETIC, together with the ART of MEASURING all Kinds of Surfaces and Solids; likewise, PRACTICAL GEOMETRY, and TRIGONOMETRY, the one for CIVIL, and the other for MILITARY ARCHITECTURE; also an *Explanation* of SINES, TANGENTS, and SECANTS, with the *Use* and *Construction* thereof.

BOOK II.

Treats of ARCHITECTURE in general, with useful Rules, Remarks, and Observations; also many useful TABLES, for the better enabling the Reader to make an exact Estimate of the Charges of erecting any Edifice great or small, due regard being had to the Conveniency and Inconveniency of Materials in different Situations; the whole illustrated with 140 CUTS.

BOOK III.

A PARALLEL of ARCHITECTURE, in a Collection of ten principal AUTHORS, who have Written upon the five *Orders*, *viz.* PALLADIO, and SCAMMOZZI; SERLIO, and VIGNOLA; BARBARO, and CATANEO; ALBERTI, and VIOLA; PERRAULT, and LE CLERC.

BOOK IV.

Several DESIGNS for Doors, Windows, Chimney Pieces, Piers, Gates, Entrances, Temples, and Pavilions.

BOOK V.

A *great Variety* of PLANS and ELEVATIONS for Parsonage and Farm-Houses, from 100 *l.* to 500 *l.* Expence, also Manufactories, Charter Schools, and Country Churches; likewise a *Variety* of DESIGNS for Gentlemen's Houses, from 500 *l.* to 100,000 *l.* Expence with a *Calculation* of the *Artificers Works*, and the Quantities of Timber, Stone, Brick, Laths, and Lime, required for erecting each Edifice.

By JOHN AHERON, ARCHITECT.

DUBLIN:

Printed for the AUTHOR,

By JOHN BUTLER, on *Cork-Hill*, MDCCLIV.

P R E F A C E.

TO expatiate on the Excellency and Uſefulneſs of *Architecture*, in a Preface, wou'd be no more than repeating what has been already ſaid by ſeveral of the antient and modern ARCHITECTS, who wrote differently on that noble Science; ſome were particular in giving us ſuch Rules and Directions as relate to the Manner of preparing the Foundation, raiſing the Wall, managing the Carpentry, and making the Lime and Mortar, &c. as the READER may find in VITRUVIUS, PALLADIO, SAVOT, and ſeveral others ſufficiently known: Others furniſhed the World with ſeveral noble and magnificent Deſigns; as PALLADIO, VIGNOLA, and INIGO JONES, whom I have diligently conſulted in compiling the following Sheets; but more particularly the late Earl of BURLINGTON, on whoſe thorough Peruſal and candid Approbation, I preſumed to get my Plates engraved, in regard that his Lordſhip was allowed by all Judges, to have a moſt refined Taſte for this noble Science: And tho' the Hand of Death hath ſnatched him away, whilſt the Deſigns lay under the Hand of the Engraver, yet I humbly hope they will meet a favourable Reception, agreeable to the Approbation of his Lordſhip, and the Uſefulneſs of the Undertaking, wherein I have given ſo many Rules and Directions, as will, I hope, enable the young Beginner, ſufficiently to comprehend the Matter contained therein.

The Standard which I uſe for my Module in all the *Orders* of *Architecture*, is the whole Diameter of the Column, taken in the groſſeſt Part, which I divide into 60 equal Parts, or Minutes.

To the whole Height of the *Tuſcan* Pillar, I aſſign 11 Modules, 40 Minutes, which I divide into 15 equal Parts; 3 whereof I give to the Pedeſtal, 10 to the Shaft of the Column, including the Baſe and Capital, and 2 to the Entablature, which I ſubdivide into 15 other equal Parts, 4 of which I allow to the Architrave, 5 to the Frize, and 6 to the Cornice; I likewiſe ſubdivide the Pedeſtal into 15 equal Parts, 3 of which I make up the Baſe or Zocle, 10 the Die, and 2 the Cornice. The ſame Proportion I aſſign to the reſt of the five *Orders*, with an additional Increaſe of 50 Minutes to the Height of each *Order*, from the *Tuſcan* to the *Corinthian* Pillar, which makes the whole Height thereof to be 15 Modules.

To the *Corinthian* Pillar, I aſſign the higheſt Rank among the five *Orders*, contrary to ſeveral other AUTHORS who aſſign the *Compoſite* or *Roman Order* the higheſt, but can aſſign no Reaſon for ſo doing, but meer Cuſtom, which in my Opinion, is not to be followed, tho' it ſhou'd have Antiquity to plead for it; for as the *Compoſite Order* is no other but a Medly chiefly compoſed of the *Ionic* and *Corinthian* Pillars, 'tis but reaſonable that it ſhou'd participate of the Groſſneſs of the one, as well as the Delicacy of the other; therefore a middle Station will better ſuit its heavy Volutas and groſs Modillions, than a higher: By the unanimous Aſſent of all judicious ARCHITECTS, the Groſs ſhou'd always ſupport the Delicate, which uſeful Maxim is overlooked here by ſuch as wou'd place the *Compoſite* over the *Corinthian*: Beſides in the Aſſemblage of *Orders*, when theſe two are to be erected, the one above the other, if the *Compoſite* be placed above the *Corinthian*, it muſt puzzle the moſt ſkilful ARCHITECT to adjuſt the Regularity that is to be obſerved between them in the Soffit of the Cornice, to form exact Squares between the Modillions, as there muſt be an equal Number of them above and below.

N. B.

N. B. When the Frize of the *Doric Order* is to be enriched with Triglyphs and Metopes, one must recede a little from the above Proportion, by increasing it a few Minutes higher, in order to have regular Squares between the Triglyphs, wherein consists the chief Beauty thereof.

The Method I follow in diminishing the upper Part of the Shaft of my Columns is thus. First, I divide it into 3 equal Parts, the lowest of which I subdivide into 12 other equal Parts, at 8 of which Parts I begin the Diminution of the *Tuscan* Column; at 9 the *Doric*, at 10 the *Ionic*, at 11 the *Composite*, and at 12 the *Corinthian*, I diminish the upper Part of the *Tuscan* Column, by $\frac{1}{5}$ of the lower Diameter, the *Doric*, by $\frac{1}{6}$; the *Ionic*, by $\frac{1}{7}$; the *Composite*, by $\frac{1}{8}$; and the *Corinthian*, by $\frac{1}{9}$.

As the Proportions which I have assigned to the five *Orders* are somewhat different from those of the Ancients, lest, at first Sight, they might seem disagreeable to the judicious Reader, I have given him the Profiles of them according to the several AUTHORS mentioned in my third Book, whereby I leave it in his Power to follow that which may best suit his Fancy.

In my Advertisement I made a Promise to the Public, to annex an Estimate to my Designs, of the Charges of erecting of them, but in considering the Thing more maturely, I thought such a Calculation would be of little or no Advantage to the Reader, by reason of the vast Differences in the Prices of Work and Materials, in different Situations; therefore rest myself content to give him a Calculation of the Artificers Works, together with the Quantity of Materials that may be sufficient for building each Design, as may be seen in the beginning of Book V.

As Roofing and Flooring are two of the most considerable and expensive Articles in a Building, I have in Page 108 Book II. given two inspectional Tables, the one which shews the Quantity of Timber required for a Square of Flooring laid with thorough Joists, and $1\frac{1}{2}$ Inch Plank, the Joists being of any Length from 8 to 52 Feet, with the proper Scantlings thereof.

The other for single Roofing, the Plates included, the Rafter being of any Length from 6 to 20 Feet, with the proper Scantlings thereof, taken in the Middle.

If the Length of the Rafter be from 20 to 25 Feet, the Roof ought to be framed with Wall Plates, Purlins, Principals, and Collar Beams.

If from 25 to 30, 35, &c. the Roof must be framed with Girders, King-posts, Trusses, Braces, Wall Plates, Purlins, and Principals; which will not only be strong of itself, but a Ligament for the further Security of the Building.

As the Length of Joists and Rafters increases, the Scantlings and Quantity of Timber in a Square of Flooring and Roofing increases accordingly; which, for want of being duly considered by Projectors, or Undertakers, renders them liable to make false Calculations in their Estimate.

Tho' I have presumed, for the Benefit of young Beginners, and those who are yet Strangers to *Architecture*, to compile this TREATISE, wherein I am chiefly a Collector of other Mens Works, except in the Designs. I don't pretend to more Infallibility than others, who are liable to commit Errors in their Calculations; therefore, if I have committed any in mine, I hope the candid Reader will spare Censuring me, or bringing my Judgment in Question for the same.

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Advertiſement.

AS ſome in our Country are fond of Copying after the *Italians* in their Buildings, who are obliged, thro' the extreme Heat of their Climate, to make their Walls very thick, and their Windows very ſmall, and few in Number, which cannot fail of giving a diſagreeable Aſpect to the Building; every good Judge, who rightly conſiders the Temperature of our Climate, the Darkneſs of our Atmoſphere, in our long and gloomy Winters, and the ſhortneſs of our Summers, muſt allow that we ought to Build in a more airy aud ſprightly Taſte, therefore our Windows ought to be larger and more in Number than thoſe of the *Italians,* to ſupply the Deficiency of Light; and alſo our Walls ought to be made thiner to accelerate the drying thereof in our ſhort Summers; it being well known that the thickneſs of the Walls in all our Buildings in *England* and *Ireland,* retains ſo much Moiſture as greatly annoys both our Health and Furniture: Beſides, a thin Wall is eaſier Bound with proper Bonds, than a thick. As no Man can lay down a Standard that might in thoſe Caſes pleaſe every ones Fancy, I obſerved a Mean in my Deſigns between the *Italians* and *French,* without running into the Extreme of the latter, who make their Houſes too luminous; I likewiſe make the Height of my Doors and Windows, double their Breadth, which is allowed by the beſt Judges among the antient and modern Architects, to be the moſt beautiful Proportion, tho' ſome are of another Opinion, who make their Windows very low, and very broad; which is inconſiſtent with the great Height we give our modern Buildings.

A GENE-

A

GENERAL TREATISE

OF

ARCHITECTURE.

BOOK I.

CHAPTER I. Vulgar Arithmetic.

SECTION I. *REDUCTION.*

REDUCTION is performed by *Multiplication* and *Diviſion*, and is two-fold, *viz.* *Reduction deſcending*, and *Reduction aſcending*: By *Reduction deſcending*, all great Denominations are brought into ſmall, and is performed by Multiplication; as Pounds multiplied by 20 are Shillings; Shillings multiplied by 12 are Pence; Pence multiplied by 4 are Farthings: Or, thus, Pounds multiplied by 240 are Pence; Pounds multiplied by 960 are Farthings. Tuns multiplied by 20 are Hundreds; Hundreds multiplied by 4 are Quarters; Quarters multiplied by 28 are Pounds; Pounds multiplied by 16 are Ounces, *&c.*

By *Reduction aſcending*, all ſmall Denominations are brought into great, and is performed by Diviſion; as Farthings divided by 4 are Pence; Pence divided by 12 are Shillings; Shillings divided by 20 are Pounds; Farthings divided by 960 are Pounds; Pence divided by 240 are Pounds. Ounces divided by 16 are Pounds; Pounds divided by 28 are Quarters of an Hundred; Quarters divided by 4 are Hundreds; Hundreds by 20 are Tuns; as ſhall be fully illuſtrated in the Examples following.

EXAMPLE I.

In 260 Pounds *Sterl.* how many Shillings, Pence, and Farthings?

The Product of 260 Pounds, multiplied by 20, is 5200 Shillings, which multiplied by 12, produces 62400, which is the Number of Pence in 260 *l.* Or, thus, if you multiply 260 Pounds by 240, the Pence in one Pound; the Product ſhall be 62400 Pence, as before.

EXAMPLE II.

In 24 Tuns, how many Hundreds, Quarters, Pounds, and Ounces?

The Product of 24 Tuns, multiplied by 20, the Hundreds in one Tun, is 480 Hundreds; the Product of which multiplied by 4, the Quarters in one Hundred, is 1920 Quarters, the Product whereof multiplied by 28, the Pounds in one Quarter, is 53760 Pounds; which being multiplied by 16, the Ounces in one Pound, produces for Anſwer, 860160, the Number of Ounces contained in 24 Tuns.

So you see, in the foregoing Examples, how great Denominations are brought into small; which, as the first Rule directeth, is done by Multiplication, by multiplying the greater Denomination by the Number of Parts of the next inferior Denomination that maketh one of the said greater; as in the last Example, the next Denomination to 1 *l.* is Shillings, 20 of which make one Pound: Wherefore I multiply Pounds by 20, the Product of which Multiplication, sheweth the Number of Shillings contained in said Pounds; The next inferior Denomination to Shillings is Pence, and because 12 of them make 1 Shilling, I multiply the Shillings by 12, the Product whereof sheweth the Number of Pence contained in the Shillings: The next inferior Denomination to Pence is Farthings, 4 of which make one Penny; therefore I multiply the Number of Pence by 4, the Product of which shews the Number of Farthings contained in the said Pence, as may be easily conceived by the Work of the foregoing Example: And the same Regard is had to, and Method followed and observed in, the Example of Weight, as is so plain to be seen in the Work, that it needs no further Explanation.

An EXAMPLE for *Reduction ascending*, is as follows.

In 4)249600 Farthings, how many Pounds, *Sterl.*?

12)62400 Pence.		Or, thus, 96|0)24960|0(260 £.
2|0)520|0 Shillings.		576
Answer. 260 Pounds.		00

In the first Method, I divide the Farthings by 4; because 4 Farthings make a Penny, and the Quotient is Pence: Next, these Pence I divide by 12; because 12 Pence make a Shilling, and the Quotient is Shillings: Which Shillings I divide by 20; because 20 Shillings make a Pound, and the Quotient is Pounds.

Note, in dividing by 20, as above, if any Thing remains, it must be joined or annexed to the Cypher or Figure cut off: As, suppose there had remained 1, (which there doth never more) it must be set before the Figure cut off; and then there would have been 10, 11, 12, *&c.* Shillings.

Bring 275640 *lb.* into Tuns: Which may be done by two different Ways.

First, divide 275640 by 28, the Quotient shall be 9844 *qrs.* 8*lb.* which if you divide by 4, the Quotient shall be 2461 *C.* which being divided by 20, the Quotient shall be 123 *T.* 01 *C.* So you have for Answer 123 *T.* 01*C.* 0*qr.* 8*lb.* Or, may be done thus; if you divide 275640 *lb.* by 112, the Number of Pounds contained in one Hundred, the Quotient shall be 2461 *C.* which if you divide by 20, the last Quotient shall be 123 *T.* as above.

When it is required to reduce the Numbers of several Denominations, into the lowest, by *Reduction descending*, you are to work as before; but you must always remember to take in such Numbers as stand in the Place of the next inferior Denomination: As, when you multiply the Pounds by 20, if there be any Shillings in the Place of Shillings, you must take them in: In like Manner, when you multiply the Shillings by 12, if there be any Pence in the Place of Pence, you must take them in: And so of the Farthings, if there be any in the Place of Farthings, as may be seen in the Work following.

EXAMPLE,

In 240 *l.* 12 *s.* $7\frac{1}{2}$ *d.* how many Farthings?

So 240 multiplied by 20, having added 12 *s.* to the Product thereof, the Sum is 4812 *s.* which being multiplied by 12, having added 7*d.* to the Product thereof, the Sum shall be 57751 *d.* which being multiplied by 4, having added 2, to the Product thereof, the Sum shall be 231006, which is the Farthings contained in 240 *l.* 12 *s.* $7\frac{1}{2}$ *d.*

The foregoing Examples, in Money and Weight, are so plain, that they need no further Explication.

Reduction ascending is the bringing Numbers from a lesser Denomination to a greater, and is the Reverse of *Reduction descending*: And each may serve as a Proof to the other; one being performed by Multiplication, and the other by Division.

And *note*, That when at any Time in *Reduction descending*, you take in, or add the odd Money, Weight, or Measure, as you multiply the several Denominations; such Quantities will be Remainders in *Reduction ascending*.

When any Number of Pieces of Money, consisting of Shillings only, is given, to be reduced to Pounds *Sterl.* multiply the Pieces given by the Number of Shillings contained in one of said Pieces, the Product shall give the Contents of all the Pieces in Shillings; which if you divide by 20, the Quotient shall be the Contents in Pounds *Sterl.* But when Pieces, consisting of Shillings and Pence, are given, to be reduced into Pounds *Sterl.* multiply the said Pieces by the Pence contained in one Piece,

Piece, and the Product ſhall be the Pence contained in all the Pieces; which if you divide by 12, and the Quotient thereof by 20, the laſt Quotient ſhall give the Contents of all the Pieces, in Pounds *Sterl.* as was required.

I ſhall, in the following Tables, ſhew, how, by *Reduction deſcending* and *aſcending*, Weights and Meaſures are changed from greater Denominations to leſſer, and from leſſer to greater.

Troy Weight.

DESCENDING.			ASCENDING.		
Pounds	multiplied by	12, are Ounces.	Grains	divided by	24, are Penny-wts.
Ounces		20, are Penny-wts.	Penny-wts.		20, are Ounces.
Penny wts.		24, are Grains.	Ounces		12, are Pounds.

Apothecary's Weight.

DESCENDING.			ASCENDING.		
Pounds	multiplied by	12, are Ounces.	Grains	divided by	20, are Scruples.
Ounces		8, are Drachms.	Scruples		3, are Drachms.
Drachms		3, are Scruples.	Drachms		8, are Ounces.
Scruples		20, are Grains.	Ounces		12, are Pounds.

Liquid Meaſure.

DESCENDING.			ASCENDING.		
Tuns	multiplied by	4, are Hogſheads.	Noggins	divided by	4, are Pints.
Hogſheads		63, are Gallons.	Pints		4, are Pottles.
Gallons		2, are Pottles.	Pottles		2, are Gallons.
Pottles		4, are Pints.	Gallons		63, are Hogſheads.
Pints		4, are Noggins.	Hogſheads		4, are Tuns.

Dry Meaſure.

DESCENDING.			ACSENDING.		
Barrels	multiplied by	4, are Buſhels.	Pints	divided by	4, are Pottles.
Buſhels		4, are Pecks.	Pottles		2, are Gallons.
Pecks		2, are Gallons.	Gallons		2, are Pecks.
Gallons		2, are Pottles.	Pecks		4, are Buſhels.
Pottles		4, are Pints.	Buſhels		4, are Barrels.

Cloth Meaſure.

DESCENDING.			ASCENDING.		
French Ells	multiplied by	6, are Qrs.	Nails	divided by	4, are Quarters.
Engliſh Ells		5, are Qrs.	Quarters		4, are Yards.
Flemiſh Ells		3, are Qrs.	Quarters		3, are Ells *Flemiſh*,
Yards		4, are Qrs.	Quarters		5, are Ells *Engliſh*.
Quarters		4, are Nails.	Quarters		6, are *French* Ells.

Land Meaſure.

DESCENDING.			ASCENDING.		
Acres	multiplied by	4, are Roods.	Inches	divided by	12, are Feet.
Roods		40, are Perches.	Feet		21, are Perches.
Perches		21, are Feet.	Perches		40, are Roods,
Feet		12, are Inches.	Roods		4, are Acres.

Long

Long Meaſure.

DESCENDING.			ASCENDING.		
Degrees	multiplied by	60, are Miles.	Bar. Corns	divided by	3, are Inches.
Miles		8, are Furlongs.	Inches		12, are Feet.
Furlongs		220, are Yards.	Feet		3, are Yards.
Yards		3, are Feet.	Yards		220, are Furlongs.
Feet		12, are Inches.	Furlongs		8, are Miles.
Inches		3, are Barly-corns.	Miles		60, are Degrees.

Time.

DESCENDING.			ASCENDING.		
Years	multiplied by	365, are Days.	Thirds	divided by	60, are Seconds.
Days		24, are Hours.	Seconds		60, are Minutes
Hours		60, are Minutes.	Minutes		60, are Hours.
Minutes		60, are Seconds.	Hours		24, are Days.
Seconds		60, are Thirds.	Days		365, are Years.

The foregoing Tables are ſo very plain, intelligible, and inſtructive, that, I believe, it is needleſs here to give any more Examples in this Rule; and ſhall proceed to the next *Section*, hoping this may ſuffice to make the Reader fully comprehend the Power and uſeful Application of Reduction *aſcending* and *deſcending*.

SECTION II.

The GOLDEN RULE; or, RULE of THREE.

IT is called the *Golden Rule*, from the excellent Performances thereof, both in Arithmetic, and moſt Parts of the Mathematics: And the *Rule of Three*, becauſe, from three Numbers given, propoſed, or known, we find out a fourth Number required, or unknown; which bears ſuch Proportion to the Third, as the Second doth to the firſt Number: From whence it is alſo called the *Rule of Proportion*.

And of this Proportion there are two Sorts; one called *Direct*, and the other *Indirect*, or *Reverſe*.

Direct Proportion is, when the ſecond and third Numbers are multiplied into one another and their Product is divided by the firſt.

Indirect, or *Reverſe Proportion* is, when the firſt and ſecond Numbers are multiplied into one another and their Product is divided by the third.

In *Direct Proportion*, the fourth Number, or Anſwer to the Queſtion, contains the third Number, as many Times as the ſecond contains the firſt.

But, in *Indirect Proportion*, the greater the third Number is, the leſs is the fourth; and the leſſer the third Number is, the greater is the fourth,

The ſtating the Queſtion.

The chief Difficulty that occurs in the *Rule of Three* is, the right placing the Numbers, or ſtating the Queſtion: For when that is done, you have nothing more to do, but to multiply and divide, and the Work is done.

And to this End, we are to remember, That of the three given Numbers, two of them *always* are of one Denomination or Kind; and the other is ever of the ſame Name with the fourth Number produced, or Anſwer required, and muſt always be the ſecond or middle Number; and the Number that aſketh the Queſtion muſt ſtill poſſeſs the third or laſt Place; and the other Number of the ſame Name with the third, muſt be the firſt Number: For, the firſt and third Numbers muſt always be of the *ſame* Name, *viz.* both Money, both Weight, both Time, or both Meaſure, *&c.* And although they be of one Kind; yet, if one of them be altered, by Reduction, from an high to a lower Denomination, then the other muſt be reduced to the ſame. For you muſt particularly *note*, That, if either the firſt or third Number conſiſts of *ſeveral* Denominations, that is, of Pounds,

and

and Shillings; or of Pounds, Shillings, and Pence; or of Tuns, Hundreds, Quarters, and Pounds, &c. then muſt they be reduced to the loweſt Name mentioned: And if one happens to be of diverſe Denominations, and the other but of one Name, then the Number of one Name muſt be reduced as low as, or into the ſame Name with the other: As, ſuppoſe the firſt Number is brought into Farthings, then the third Number, although even Pounds, muſt be brought into Farthings alſo; afterwards, you are to multiply the ſecond and third Numbers together (when the Proportion is *Direct*) and divide the Product by the firſt Number, the Quotient thence ariſing will be the Anſwer to the Queſtion, and of the ſame Name with the middle Number: And if in a ſmall Denomination, it muſt be brought, by Diviſion, to the higheſt Name, for the better underſtanding the Anſwer. You muſt alſo *note*, That, if the *middle* Number be of ſeveral Denominations, you muſt by Reduction, bring it to the loweſt Name mentioned.

EXAMPLE.

If 12 Gallons of Brandy coſt 4 *l.* 10 *s.* what will 134 Gallons coſt, at that Rate?

Stated for working, as follows,

Gall. Gall.
If 12——4*l.*—10*s.*——134
20 90
———
90 12)12060
———
2|0)100|5
———
Anſwer. 50 *l.* 5*s.*

Here, the firſt and third Numbers are of like Name, *viz.* both Gallons, and 134 being the Number that aſketh the Queſtion, hath the third Place, as it always muſt, as before aſſerted. And 4 *l.* 10 *s.* the ſecond Number, being of two Denominations, *viz.* Pounds and Shillings, it is reduced into the loweſt mentioned, *viz.* Shillings, as before directed; and then the three Numbers are theſe, *viz.* 12—90—134; and 134, the third Number, being multiplied by 90, the ſecond Number, produces 12060; which divided by 12, the firſt Number, quotes 1005 Shillings, the Name of the middle Number 90; and 1005 Shillings, divided by 20, gives 50 *l.* 5 *s.* for the Anſwer: And for the Proof of it's Truth, State it back again, thus;

EXAMPLE II.

So you ſee, for Proof, that 4*l.* 10*s.* is the Coſt of 12 Gallons: and the back Stating and working the Proof, is as much a Queſtion in the *Rule of Three*, as the firſt,

Gall. Gall.
If 134 coſt 50*l.* 5*s.* what 12?
20
———
1005
12
———
~~143~~ 134)12060(90*s.* or 4*l.* 10*s.*

By the foregoing Rules and Directions, and theſe two Operations, you may underſtand the Nature of the Rule, and Method of Working; and, with Eaſe and Certainty, anſwer any Example propoſed in the *Rule of Three Direct*: And therefore, I ſhall abate as much of Figure-Work, as is conſiſtent with Diſpatch, to avoid Prolixity: To which End, I ſhall only give the Examples ſtated, and a little of the Work, and the Anſwers to the Queſtions; leaving moſt of the Operations, to be performed by the ingenious Practitioners.

EXAMPLE III.

If 56 *lb.* of Indigo coſt 11 *l.* 4*s.* what will 1008 *lb.* coſt at that Rate?

If 56 *lb.*——224 *s.*——1008 *lb.*? Anſwer, 4032 Shillings, or, 201 *l.* 12 *s.*

EXAMPLE IV.

If half a *C. Wt.* of Copper coſt 4 *l.* 18 *s.* what Quantity will 14 *s.* buy, at that Rate?

If 98 *s.*——56 *lb.*——14 *s.*? Anſwer, 8 *lb.* of Copper.

EXAMPLE V.

If 4 *C.* 3 *qrs.* of Sugar coſt 5 *l.* 15 *s.* 7 *d.* what will 4 *Hhds.* come to, Weight 42 *C.* 1 *qr.* 14 *lb.*?

If 532 *lb.*——1387 *d.*——4746 *lb.*? Anſr. 12373 *d.* or 51 *l.* 11 *s.* 1 *d.* and the Remainder 266, multiplied by 4, gives 1064; which alſo divided by the firſt Number 532, gives an Half-penny more: So, the Whole is 51 *l.* 11 *s.* 7*d.* ½ 1¼

Any of theſe Examples, or any other, may be proved by a back Stating; as the firſt Example was proved; and each Proof becomes another Queſtion, in the *Rule of Three*, as before.

EXAMPLE VI.

If I have 50 *l.* a Year, Sallary, how much is due to me for 144 Days Service, at that Rate?

D. £. *D.*
If 365——50——144? Anſ. 19 *l.* 14 *s.* 6 *d.* $\frac{90}{365}$ Parts of a Penny.

In this Example, the Product of the third multiplied by the second Number is 7200, which, divided by the first, 365, quotes 19 *l.* the Name of the middle Number, and there is a Remainder of 265; which, multiplied by 20, according to Reduction, and the Product still divided by 365, there come out 14 *s.* And yet there is a Remainder of 190; which, multiplied by 12, and the Product divided by 365, gives 6 *d.* and there is a Remainder of 90; which, multiplied by 4 (the last inferior Name,) and divided by 365, yet would not come to a Farthing more: So that the Answer is 19 *l.* 14 *s.* 6 *d.* $\frac{90}{365}$.

You are to *note, always,* That, when any Thing remains that is reducible to an inferior or lower Name, after multiplied as above, it must continually be divided by the first Number.

Note, also, when the first of three given Numbers is an Unit, or One, the Work is performed, or Answer found, by Multiplication.

EXAMPLE VII.

If I am to give 17 *s.* for 1 *lb.* of Silk, what must I give for 264 *lb.* at that Rate?

If 1 *lb.*——17 *s.*——264 *lb.*? Answr. 4488 *s.* or 224 *l.* 8 *s.*

When the third or the last of the three given Numbers is an Unit, or One; then the Work is performed by Division.

EXAMPLE VIII.

If 12 Ells of Holland cost 3 *l.* 6 *s.* What is the Price of an Ell at that Rate?

E. 12) *s.* *E.*

If 12——66——1?

Answr. 5 *s.* 6 *d.*

EXAMPLE IX.

If 56 Yards of Broad-cloath cost 40 *l.* 12 *s.* what comes it to *per* Yard?

Yds. £. *s.* *Yds.*

If 56——40—12——1? Ans. 14 *s.* 6 *d.* *per* Yard.

EXAMPLE X.

If A owes B 296 *l.* 17 *s.* and compounds at 7 *s.* 6 *d.* in the Pound, what must he take for his Debt?

s. *d.* *s.*

If 20——90——5937? Answer. 111 *l.* 6*s.* 4*d.*$\frac{1}{2}$

EXAMPLE XI.

If a Gentleman hath an Estate of 500 *l.* a Year, what may he expend daily, and yet lay up 12 *l.* 15 *s.* *per* Month?

First, multiply 12 *l.* 15 *s.* by 12, the Months in a Year, and it makes 153 *l.* which deducted from 500 *l.* the Remainder is 347 *l.* Then say,

If 365——347——1. Answer. 19 *s.* *per* Day.

After you have reduced the Pounds into Shillings, which make 6940; you divide them by 365, and the Quotient is 19 *s.* *per* Day.

SECTION III.

The RULE of THREE *Reverse*, or *Indirect Proportion.*

WHAT *Direct Proportion* is, hath been already hinted.

In *Direct Proportion* the Product of the first and fourth Numbers is equal to the Product of the second and third.

But, in this Proportion, the Product of the third and fourth is equal to the Product of the first and second.

The Method of Stating any Question in this Rule, is the same with that of the *Direct* Rule.

For, the first and third Numbers must be of one Name, or so reduced, as in that Rule; and the Number that asketh the Question must possess the third Place; and the middle Number will be of the same Name with the Answer, as it is there.

To know when the Question belongs to the *Direct*, and when to the *Reverse* Rule:

When the Question is stated, as above; consider whether the Answer thereto ought to be *more* or *less* than the second Number; if more, then the lesser of the first and third Numbers must be your Divisor.

But if less, then the greater of the two extreme Numbers must be your Divisor.

And

And if the firſt Number of the three is your Diviſor, then the Proportion is *Direct:* But if the laſt of the three given Numbers is your Diviſor, the Proportion is *Indirect*, or *Reverſe*.

Or, without Regard to either *Direct* or *Indirect*,

If *more* is required, the leſſer } is Diviſor.
If *leſs*, the greater. }

EXAMPLE I.

If 4 Men plane 600 Deal Boards in 12 Days, how many Men will plane them in 4 Days?

If 12 Days require 4 Men, what will 4 Days require?

12

4)48(12 Anſwer.

EXAMPLE II.

If a Board be 9 Inches broad, how much in Length of it will make a Square Foot?

In. b. *In. l.* *In. b.*
If 12——12——9
12
9)144(16 Inches broad for Anſr.

In this Example, the firſt and ſecond Numbers are multiplied together, (as they always muſt be) and their Product is divided by the third; as is the Example above it, and agreeable to the aforeſaid Aſſertion: For, in the firſt Example, it is moſt certain, that 4 Days will require more Hands to perform the Work than 12 Days; therefore, the leſſer of the extreme Numbers is the Diviſor, and declares the Queſtion to be the *Indirect Proportion.*

Likewiſe, in the ſecond Example, 9 Inches in Breadth muſt needs require more in Length, to make a Foot than 12; wherefore it is in the ſame Proportion with the firſt Example, becauſe the Diviſor is the third Number.

EXAMPLE III.

How many Pounds of Coffee, at 5 *s.* 9 *d. per lb.* are equivalent, in Value, to 426 *lb.* of Tea, at 13 *s.* 4 *d. per lb.*?

If 160 *d.*——426 *lb.*——69 *d.*? Anſwer, 987 *lb.* $\frac{57}{69}$

Here, it is manifeſt that there muſt be more Pounds of the Coffee than the Tea; therefore, 69 is the Diviſor, which is the third Number.

EXAMPLE IV.

How many Yards of Sarcenet, of 3 *qrs.* wide, will line 9 Yards of Cloth, 8 *qrs.* wide?

qrs. w. *qrs. w.* *qrs. w.*
If 8——9——3
8
3)72(24 Yards, for Anſwer.

EXAMPLE V.

If a Quartern Loaf weighs 4½ *lb.* when Wheat is ſold at 5 *s.* 6 *d.* a Buſhel; what muſt it weigh, when Wheat is 4 *s.* the Buſhel?

d. *lb.* *d.*
If 66——9½——48. Anſ. 6 lb. $\frac{3}{8}$.

EXAMPLE VI.

If, in 12 Months, 100 *l.* Principal, gain 50 *l.* Intereſt, what Principal will gain the ſame Intereſt in 5 Months?

M. *l. P.* *M.*
If 12——100——5 Anſw. 240 *l.* Principal.

SECTION IV.

The DOUBLE RULE of THREE *Direct.*

IN this Rule, there are five Numbers given, to find out a ſixth, in Proportion to the Product of the fourth and fifth Numbers, as the third Number bears to the Product of the firſt and ſecond.

Queſtions in this Kind of Proportion, are wrought either by two Operations in the *Single Rule of Three Direct*, or by a Rule compoſed of five given Numbers, and the one may be a Proof of the other; as may be ſeen in the Example following.

EX-

EXAMPLE.

If 100 *l.* Principal, in 12 Months, gain 5 *l.* Intereſt, what will 246 *l.* Principal gain in 7 Months?

```
If 100 l.——gain 5 l. what 246?                    Then ſay;
                           5                 M.      l.  6 s.     M.
                         ———                If 12———12. 6.———7?
                 1|00)12|30                         20
                         20                        ———
                         ———                       246
Anſwr. 12 l. 6 s.      6.00                          7
                                                   ——— 2|0
                                             12)1722(14|3 s. 6 d.
                                                   Anſ. 7 l. 3 s. 6 d.
```

In the firſt Stating, the Anſwer is, that if 100 *l.* gain 5 *l.* the 246 *l.* will gain 12 *l.* 6 *s.*

Then I ſay, in the next Stating, if 12 Months gain 12 *l.* 6 *s.* what will 7 Months gain? and the Anſwer of the Work is 7 *l.* 3 *s.* 6 *d.* and ſo much will 246 *l.* gain in 7 Months, when 100 *l.* gain 5 *l.* in 12 Months.

You muſt particularly *note*, that, in all Operations, where the Anſwer to the Queſtion is found by two *Rules of Three*, the Anſwer of the firſt Stating is ever the middle Number of the ſecond Stating, or Work; as in the preceding Example is plainly ſeen.

The foregoing Queſtion anſwered by a Rule compoſed of the 5 given Numbers, thus:

```
    £.    M.    £.    £.    M.
If 100——12——5——246——7.
    12                5
   ———              ———
  1200              1230
                       7
                     ———
              12|00)86|10(7 l.
                     ———
                     210
                      20
                     ———
              12|00)42|00(3 s.
                     ———
                     600
                      12
                     ———
              12|00)72|00(6 d.
                     ———
                       0
```

In this Work, in Stating the Queſtion, the firſt and fourth Numbers are made of one Name, and the ſecond and fifth; and then the two firſt Numbers are multiplied into one another for a Diviſor, and the laſt three Numbers are multiplied into one another for a Dividend, and the Quotient, or Anſwer, is of the ſame Denomination with the middle Number, *viz.* Pounds Intereſt, as in the Work; I find the Quotient 7 Pounds Intereſt; and ſo I proceed from one Denomination to another, until I find the ſame Anſwer, as in the Work of two Statings, *viz.* 7 *l.* 3 *s.* 6 *d.*

This Method of Operation ſerves to Anſwer all Queſtions in the *Double Rule of Three Direct.*

SECTION V.

The DOUBLE RULE of THREE *Reverſe.*

IN this Rule, as in the laſt, there are five known Numbers, whereby a ſixth is found out, which may be done after two Manner of Ways, *viz.* The one in the *ſingle Rule of Three*, by two Operations, one of which muſt be *Direct*, and the other *Indirect*; obſerving always, that the Anſwer found by the firſt Operation muſt be the *middle* Number, in the ſecond Stating.

The other is performed by one Operation, where the five Numbers given are placed in one continued Rank, in ſuch Order that your ſecond and fourth Numbers may be of one Denomination, and your third and fifth.

EX-

EXAMPLE,

If 100 *l.* Principal, in 12 Months, gain 6 *l.* Intereſt, what Principal will gain 20 *l.* Intereſt in 8 Months? £. *M* £. *M.* £.

If 100——12——6——8——20?
12 6
—— ——
1200 48
20
——
48)24000(500 *l.* Anſwer.

In this Work, the third and fourth Numbers are multiplied into one another, for a Diviſor; next, the firſt is multiplied by the ſecond, and that Product by the fifth Number; and the laſt Product, 24000, is divided by 48, and the Quotient is 500 *l.* Principal: Which is the Sum that will gain 20 *l.* Intereſt in 8 Months, and the Anſwer to the Queſtion, as may be ſeen in the Work.

SECTION VI.

RULES of PRACTICE.

THESE Rules are ſo called, from their frequent Uſe and Brevity in caſting up moſt Sorts of Goods and Merchandize.

Note, That any Queſtion in the *Rule of Three,* when the firſt Number in Stating is 1, is moſt briefly done by theſe Rules, called *Practice.*

But, previous to the Rules, it is neceſſary to have the following Tables by Heart.

Parts of a Shilling, Of a Pound.

d.		Shilling		Pound
6	is	$\frac{1}{2}$	——	$\frac{1}{40}$
4		$\frac{1}{3}$	——	$\frac{1}{60}$
3		$\frac{1}{4}$	——	$\frac{1}{80}$
2		$\frac{1}{6}$	——	$\frac{1}{120}$
$1\frac{1}{2}$		$\frac{1}{8}$		
1		$\frac{1}{12}$		

Parts of a Pound.

s.	*d.*		
10	0	is	$\frac{1}{2}$
6	8	—	$\frac{1}{3}$
5	0	—	$\frac{1}{4}$
4	0	—	$\frac{1}{5}$
3	4	—	$\frac{1}{6}$
2	6	—	$\frac{1}{8}$
2	0	—	$\frac{1}{10}$
1	8	—	$\frac{1}{12}$
1	0	—	$\frac{1}{20}$

A Table of Pence.

d.		*s.*	*d.*
20	is	1 —	8
30		2 —	6
40		3 —	4
50		4 —	2
60		5 —	0
70		5 —	10
80		6 —	8
90		7 —	6
100		8 —	4

Part of a Shilling.

6 *d.* is $\frac{1}{2}$ of a Shil. } 426 *lb.* of Sugar, at 6 *d.* *per lb.*
——
2|0)21|3
——
£. 10—13 Anſwer.

Here, 6 *d.* being the Price of each Pound, and the Half of a Shilling; therefore the Half of 426 is taken, and gives 213 *s.* or 10 *l.* 13 *s.*

EXAMPLE II.

4 *d.* is $\frac{1}{3}$ of a Shil. } 512 *lb.* of Cheeſe, at 4 *d.* *per lb.*
——
2|0)17|0—8 *d.*
——
£ 8—10 *s.*—8 *d.* Anſwer.

Here, in Example II. 4 *d,* is $\frac{1}{3}$ of a Shilling, therefore the third Part of 512 is 170 *s,* $\frac{2}{3}$ of a Shilling, or 8 *d.* remains.

Note always, what remains is of the ſame Name with the Dividend, which here is Groats: For the Pounds of Cheeſe are at a Groat each.

EXAMPLE III.

246 *Yds.* at 3 *d.* *per* Yard.
——
2|0)6|1 $\frac{1}{2}$ of a Shil. or 6 *d.*
——
£. 3—1 *s.*—6 *d.*

Example III. Here, the Yards are divided by 4, becauſe 3 *d.* is the *4th,* of a Shilling; and it quotes 61 *s.* and 2 remains, or twice 3 Pence: So the Anſwer is 3 *l.* 1 *s.* 6 *d.*

And thus, may any propoſed Queſtion be anſwered, belonging to the firſt Table, or Parts of a Shilling, that is, by dividing the given Number by the Denominator, or under-Number of the

Fraction, and the Quotient will be always Shillings, which, (the Remainders being known, as above) bring into Pounds, by dividing by 20.

When the Price of the Integer is at a Farthing, an Half-penny, or three Farthings, more than the Price of Pence mentioned; then, for those Farthings take their even Part of the foregoing Quotient taken for the even Parts of a Shilling, and add, *&c.*

EXAMPLE IV.

$\frac{1}{3}$)249 Ells of Canvas, at 4 *d.* $\frac{1}{2}$ *per* Yard.	
$\frac{1}{8}$)83	
10 $\frac{3}{8}$	
2|0)9|3.4 $\frac{1}{2}$	
£. 4—13*s*—4 *d*, $\frac{1}{2}$	

In this Example, I divide by 3 for the Groats, as being $\frac{1}{3}$ of a Shilling, and it quot[es] 83 *s.* then I consider that an Half-penny is $\frac{1}{8}$ of 4 *d.* therefore I take $\frac{1}{8}$ of the Groat Line, or 83 *s.* and that produces 10 *s.* $\frac{3}{8}$ of a Shilling; then the two Lines being added together, make 4 *l.* 13 *s.* 4 *d* $\frac{1}{2}$, as may be seen in the Work.

Parts of a Pound.

254 Yards of Cloth, at 10 *s.* *per* Yard.
127 *l.* Answer.

Here, the Half of 254 is taken, because 10 *s.* is the Half of a Pound.

$\frac{1}{3}$)927 Gallons of Brandy, at 6 *s.* 8 *d.* *per* Gal.
£. 309 Answer.

Here, the third Part is taken, because 6 *s.* 8 *d.* is one Third of a Pound, and the Answer is 309 *l.*

And thus may any Question proposed be answered, belonging to the second Table, or Parts of a Pound; that is, by dividing the given Number by the Denominator of the Fraction, and the Quotient will be always Pounds; and if any Thing remains, it is always so many Halves, Thirds Fourths, or Fifths, *&c.* of a Pound, according to the Denominator that you divide by.

If the Price be Shillings and Pence, or Shillings, Pence, and Farthings, and no even Part of a Pound; then multiply the given Number hy the Shillings in the Price, and take even Parts for the Pence, or Pence and Farthings, and add the several Lines together, and they will be Shillings; which Shillings bring into Pounds, as before.

lb.	*Ells.*	
496 at 4 *s.* 9 *d.* *per.*	216 at 2 *s.* 3 *d.* $\frac{1}{4}$ *per.*	396 at 7 *s.* 9 *d.* *per.*
4	2	7
1984 for 4 *s.*	432 for 2 *s.*	2772 for 7 *s.*
248 for 6 *d.*	54 for 3 *d.*	198 for 6 *d.*
124 6 *d.* for 3 *d.*	9 for $\frac{1}{4}$ *d.*	99 for 3 *d.*
2|0)235|6	2|0)49|5	2|0)306|9
£. 117. 6 *s.* 6 *d.* Answer.	£. 24 15 *s.* Answer.	£. 153.9 Answer.

When the Price is 10 *d.* only annex 0 to the right side of the given Number (which is multiplying by 10) and they are Pence; which divide by 12, and by 20, and you have them in Pounds.

EXAMPLE. 426 *lb.* of Hops, at 10 *d.* *per* Pound.

12)4260

2|0)35|5

17*l.* 15*s.* Answer.

When the Price is 11 *d.* set down the Quantity twice, in the Form of Multiplication, and add the two Lines together; then divide by 12, and by 20.

If the Price be 11 *d.* $\frac{1}{2}$, take Half the uppermost Line, and add it to the rest.

When the Price is 1 *s.* only divide by 20. Examples, as follow.

426 *lb.* at 11 *d.* *per.*	942 *lb.* at 11 *d.* $\frac{1}{2}$ *per.*	
426	942	
	471	2|0)96|4 *lb.* at 1 *s.* *per.*
12)4686	12)10833	£. 48. 4 *s.* Answer.
2|0)39|0—6 *d.*	2|0)90|2	
£. 19.10.6 Answer.	£. 45.2.9 Answer.	

When

When the Price is 2 *s.* it is done at Sight, by doubling the laſt Figure towards the Right-Hand, and ſetting it apart, for Shillings; and the Figures towards the Left-Hand, are Pounds.

EXAMPLE.

59|6 Gallons of Spirits, at 2 *s. per* Gallon.
£. 59—12 Anſwer.

Here, the Double of 6 is 12 *s.* and the 59 are Pounds.

From this Method of working by 2 *s.* a Multitude of Examples may be moſt expeditiouſly wrought.

444 *lb.* at 5 *s.* 9 *d. per lb.*

44	8	at	2 *s.*
44	8	at	2 *s.*
22	4	at	1 *s.*
11	2	at	6 *d.*
5	11	at	3 *d.*
127—13		at	5 *s.* 9. Anſwer.

Yds.
426 at 3 *s.* 6 *d. per.*

42	12	at	2 *s.*
21	6	at	1 *s.*
10	13	at	6 *d.*
£. 74—11		at	3 *s.* 6 *d.* Anſwer.

The Operations of the foregoing Examples are ſo intelligibly performed, that verbal Explanations are needleſs.

When the Price is an even Number of Shillings, multiply the Number of Integers by Half the Price, and double the firſt Figure of the Product for Shillings, and carry as is uſual in Multiplication, and the other Figures towards the Left will be Pounds.

EXAMPLE.

296 *lb.* of Silk, at 14 *s. per lb.*
7

£. 207—4 *s.* Anſwer.

Here, 7 Times 6 is 42; the Double of 2 *s.* is 4 *s.* &c.

When the Price is an odd Number of Shillings, work for the even Number, as above; and for the odd Shillings, take 1/20 of the given Number, and add them together.

EXAMPLE.

496 Gallons of Citron Water, at 17 *s. per* Gal.
8

396—16
24—16

£. 421—12 Anſwer.

In this Example, I ſay, 8 Times 6 is 48; the Double of 8 is 16, and carry 4; then 8 Times 9 is 72, and 4 is 76; 6 and carry 7; and 8 Times 4 is 32 and 7 is 39; then the Half of 4 is 2; and the Half of 9 is 4 and an Half, which makes 10 *s*, which I add to 6, and it is 16 *s.*

I ſhall conclude this Chapter with a few *General Rules*, which, if heedfully noted, will be of great Uſe to Learners, and are theſe, *viz.*

I. When the Price is Parts of a Farthing, or of a Penny, as ¾, ½, ¼, &c. then multiply the Integers by the Numerator, and divide by the Denominator, and the Reſult will be either Farthings, or Pence, which bring to Pounds.

II. When the Price is Pence, and no even Part of a Shilling, as ſuppoſe 5 *d.* 7 *d.* or 8 *d.* then it may be done, by taking the Parts; as 2 *d.* and 3 *d.* is 5 *d.* alſo, 4 *d.* and 3 *d.* is 7 *d.* &c. But it is an eaſy and ſure Way, to multiply the given Number by 5, 7, or 8, and the Product is Pence, which bring to Pounds.

III. When the Price is Pence, and Parts of a Penny, as 1 *d.* ¼, 2 *d.* ½ or 3 *d.* ¾, then work for the Penny, by taking 1/12; for 2 *d.* 1/6, and for 3 *d.* ¼; then for the Farthings, take ¼ of the Penny Line; and for ¾ take ⅛ of the Six-penny Line; and for ½, ¼ of the Two-penny Line; then add their Reſults together, and the Total will be Shillings; which reduce to Pounds: Or, by the ſure Way of bringing the mixed Number into the loweſt Denomination, as 1 *d.* ¼ into 5 *qrs.* 2 *d* ½ into 5 Half-pence, and 3 *d.* ¾ into 15 Farthings; multiply the Integers by 5, and the Product is Farthings, or by 5 Half-pence and the Product will be Half-pence, or by 15 *qrs.* and the Product will be Quarters, or Farthings; which, whether Pence, Half-pence, or Farthings, reduce to Pounds.

IV. When

IV. When the Price is Shillings, and Pence, or Shillings, Pence, and Farthings, multiply the Integers by the Shillings of the Price, and take Parts for the Pence.

V. If the Price be Pounds and Shillings, or Pounds, Shillings, Pence, and Farthings; multiply by the Shillings in the Price, that is, in the Pounds and Shillings, and take Parts for the Pence and Farthings.

VI. When the Number of Integers hath a Fraction annexed or belonging to it, as $\frac{1}{4}$ $\frac{1}{2}$ $\frac{3}{4}$ *&c.* then take $\frac{1}{4}$ $\frac{1}{2}$ or $\frac{3}{4}$ of the Price of one of the Integers, and add it to the other Results.

CHAPTER II.

Of FRACTIONS, *Vulgar* and *Decimal.*

SECTION I.

FRACTIONS are Nothing else, but a broken Part, or Parts, of an Integer; and are generally said to arise from Division: For the Remainders found, after Division is finished, are called Fractions; and are supposed part of the Divisor. Admit 44 *l.* is divided into 12 equal Parts; the Quotient is 4, and the Remainder 6; So that, here, 6 is 6 Parts of 12, or 6 Twelfths, equal to an Half: For 6 is the Half of Twelve, and set down in this Form $\frac{6}{12}$; and understood or known by these Names, *viz.*

$\frac{6}{12}$ Numerator. / Denominator.

The Numerator is above the short Line, and sheweth the Number of Parts; and the Denominator is under the Line, and declares the Number of equal Parts which the Integer, or whole Number, is divided into; as above, 44 *l.* is divided into 4 Parts, and the Quotient says there are 4 of these 12 Parts contained in 44, and 6 remains, or 6 Twelfths of a Pound, or 10 *s.* as above-said.

Fractions are thus set down, *viz.* and read $\frac{1}{4}$ one Fourth; $\frac{1}{2}$ one Half; $\frac{1}{3}$ one Third; $\frac{1}{5}$ one Fifth; $\frac{1}{6}$ one Sixth; $\frac{2}{3}$ two Thirds; $\frac{2}{4}$ two Fourths; $\frac{2}{6}$ two Sixths; $\frac{5}{7}$ five Sevenths, *&c.*

Fractions are either proper, or improper: A *proper Fraction* hath its Numerator less than its Denominator; as $\frac{5}{8}$ five Eighths; $\frac{24}{56}$ twenty four fifty Sixths, *&c.*

An *improper Fraction* hath its Numerator equal to, or greater than, its Denominator; $\frac{7}{3}$ seven Thirds; $\frac{48}{15}$ forty eight Fifteenths, *&c.*

Again; Fractions are either *simple* or *compound*; *Simple* is, when Part of an Integer, or Thing, hath but one Numerator, and one Denominator, as $\frac{3}{4}$ of a Pound *Sterling*, $\frac{1}{2}$ of a Hundred Weight, $\frac{2}{3}$ of a Tun, $\frac{1}{6}$ of a Gallon, *&c.* *Compound* is, a Fraction of a Fraction, as the $\frac{1}{2}$ of $\frac{1}{4}$ of a Pound *Sterling* is equal to Half a Crown; or, when one is divided into any Number of Parts, and those Parts again subdivided into other Parts, *&c.*

Fractions are of two Kinds, *viz,* Vulgar and Decimal, Vulgar Fractions are, as declared before: Decimal Fractions are artificially expressed, by setting down the Numerators only, the Denominators being understood, and always an Unit with as many Cyphers annexed as there are Places in the Numerator; and therefore must be either 10, or some Power of 10, as 100, 1000, 10000, or 100000, *&c.*

Decimal Fractions appear as whole Numbers, (and in the General are so wrought;) but are distinguished from them by a Point, or Comma, prefixed thus; ,5 which is read five Tenths; ,32 thirty-two Hundreths; ,256 two hundred and fifty six Thousandths: But of Decimal Fractions, and their Use, hereafter,

REDUC-

REDUCTION of VULGAR FRACTIONS.

REDUCTION of Vulgar Fractions muſt be firſt Learned, to fit, or prepare the Reader for Addition, Subſtraction, Multiplication, and Diviſion.

I. *To reduce a mixed Number to an improper Fraction.*

The Rule is, multiply the Integer by the Denominator, and take in the Numerator;

EXAMPLE

Reduce 12 Gallons $\frac{3}{4}$ to an improper Fraction; thus.

$$\begin{array}{l} 4 \\ \hline 51 \end{array}$$

51 Anſwer, 51 Fourths.

II. *To reduce an improper Fraction to a whole or mixed Number.*

EXAMPLE.

The Rule is, divide the Numerator by the Denominator, and it is done.
Reduce the laſt Example to a mixed Number, *viz.*

$\frac{51}{4}$ $\quad$ 4)51(12 $\frac{3}{4}$ — 3 Remainder.

Here, 12 Gallons is the whole Number, and $\frac{3}{4}$ the Fraction, the ſame with three Quarts.

III. *To reduce Fractions to a common Denominator.*

The Rule is; multiply the Numerator of each Fraction into all the Denominators, except its own, and the Product will be a new Numerator to that Fraction; and then do ſo by the next, *&c.* Laſtly, multiply all the Denominators into one another, which will be a common Denominator to all the Numerators laſt found.

EXAMPLE.

Reduce $\frac{2}{3}$ $\frac{3}{4}$ and $\frac{5}{6}$ of 20*s.* or any other Integer, or Thing, to a common Denominator. Say, twice 4 is 8, and 6 Times 8 is 48, for a new Numerator to $\frac{2}{3}$: Then, ſay, 3 Times 3 is 9, and 6 Times 9 is 54, for a new Numerator to $\frac{3}{4}$: Laſtly, ſay, 5 Times 4 is 20, and 3 Times 20 is 60, the Numerator to $\frac{5}{6}$: Then to find the common Denominator, ſay, 3 Times 4 is 12, and 6 Times 12 is 72, the common Denominator: So that $\frac{48}{72}$ is equal to $\frac{2}{3}$; $\frac{54}{72}$ to $\frac{3}{4}$; and $\frac{60}{72}$ to $\frac{5}{6}$; and thus proved.

	s. — *d.*	Numerators.		
$\frac{2}{3}$ of a Pound is	13—4	48	Added together, make	162
$\frac{3}{4}$ ——— ———	15—0	54		
$\frac{5}{6}$ ——— ———	16—8	60	The common Denominator.	72
	45—0			

Here, the ſeveral Numerators, added together, make 162, which, placed over the common Denominator, 72, make the improper Fraction $\frac{162}{72}$, and its Value is found, as before directed, in reducing an improper Fraction to a whole or mixed Number.

IV. *To reduce a Fraction to its loweſt Terms.*

The Rule is, if they are even Numbers, take Half of the Numerator and Denominator, as long as you can; and then divide them by any digit Number (*i. e.* 3, 4, 5, 6, *&c.*) that will leave no Remainder in either.

EXAMPLE.

Reduce $\frac{56}{84}$ into its loweſt Terms: Say, the $\frac{1}{2}$ of 56 is 28, and the $\frac{1}{2}$ of 84 is 42; again, the $\frac{1}{2}$ of 28 is 14, and the $\frac{1}{2}$ of 42 is 21: So the Fraction $\frac{56}{84}$ is reduced to $\frac{14}{21}$. And ſince they both are not to be halved any longer, (for, tho' you can halve 14; yet you cannot 21, without a Remainder:) Try, therefore, to divide them by ſome other digit Number; and you will find, that 7 will divide both Numerator, and Denominator, without any Remainder: Then, ſay, 7 is in 14 twice, and in 21, three Times: So is the Fraction $\frac{14}{21}$ reduced into its loweſt Terms, $\frac{2}{3}$ two Thirds, and is the ſame in Value, with $\frac{56}{84}$, and done in this Form.

2)	2)	7)	
56	28	14	2
84	42	21	3

And the Certainty that $\frac{2}{3}$ is of the ſame Value with $\frac{56}{84}$ is found, by multiplying any Integer, by the Numerator of each Fraction, and dividing by the Denominator of each Fraction: As an Example:

Let the Integer be 1 *l. Sterl.* or 20 *s.*

```
         2                    20
        ——                    56
  3)40(13s.—4d.             ————
                       84)1120(13 s. 4 d.
                            ————
                             280
                            ————
                              28
                              12
                            ————
                         84)336(4
```

Here, it is manifest, that, by working by a Fraction, in its lowest Terms, much Time and Figures are saved. In one Operation 20, the Integer, is multiplied by 2, and the Product 40 divided by 3, and there remains 1, ⅓ of a Shilling, or a Groat, as in the other Work.

There are other Methods for reducing a Fraction into its lowest Terms; but hardly any so ready as the foregoing.

V. *To reduce a compound Fraction to a simple one of the same Value.*

The Rule is, multiply the Numerators into one another, for a new Numerator; and likewise the Denominators into one another, for a Denominator.

EXAMPLE.

Reduce ⅔ of ¾ of ⅚ of a Pound *Sterling* into a simple Fraction. Say, twice 3 is 6, and 5 Times 6 is 30, the Numerator: Then, 3 Times 4 is 12, and 6 Times 12 is 72, the Denominator: So $\frac{30}{72}$ of a Pound is equivalent to ⅔ of ¾ of ⅚ of a £. Thus proved; ⅚ of a £. is 16 *s.* 8 *d.* and ¾ of the same is 12 *s.* 6 *d.* and ⅔ of 12 *s.* 6 *d.* is 8 *s.* 4 *d.* the Answer: And multiplying 20 by 30, and dividing by 72, gives the same Answer. The Thing is so plain, that an Operation is needless.

VI. *To reduce a compound Fraction to a simple one, of the same Value.*

The Rule is, multiply the Integer by the Numerator, and divide by the Denominator; and if any Thing remains, multiply it by the Number of Units in the next inferior Denomination.

EXAMPLE.

What is the Value of ⅚ of a Tun Weight?

```
                  20 the Integer.
                   5 the Numerator.
                 ————
The Denomi. 6)100
                 ————
             6.16—4 remains.
                   4 qrs. 1 C.
                 ————
               6)16
                 —
           qrs. 2—4 remains.
                  28 lb. 1 qr.
                 ————
             6)112(18 4/6
```

Here, the Integer 20 *C.* is multiplied by the Numerator 5; and the Product of 100 divided by the Denominator 6; and the Remainder 4 is multiplied by the Parts of the next inferior Denomination, to wit, 4 *qrs.* and the Product is 16; which is still divided by the Denominator 6, and there remains 4; which is still multiplied by the Parts of the next inferior Denomination, and the Product is 112; which is again divided by the Denominator 6: So the Answer, or Value of ⅚ of a Tun is 16 *C.* 2 *qrs.* 18 *lb.* $\frac{4}{6}$ or ⅔ of a Pound Weight.

ADDITION of VULGAR FRACTIONS.

I. IF the Fractions to be added have a common Denominator, add the Numerators together, for a Numerator, and place the Sum over the common Denominator.

Add ⅖, ⅗, and ⅘ of a Pound *Sterling* together. Say, 2 and 3 is 5, and 4 is 9, for the Numerator; which may be placed over 5, the common Denominator; thus, $\frac{9}{5}$; and this improper Fraction $\frac{9}{5}$ is in Value 36 *s.* For, 9 Times 4 *s.* (the 5th of a Pound) is 36 *s.*

But if the Fractions, to be added, have unequal Denominators; then they must be reduced to a common Denominator, by the Rule before shewn, before Addition can be made; and then proceed with your Addition, as above.

II. When

II. When mixed Numbers are to be added, work with the fractional Parts, as before, and carry the fractional Value to the whole Numbers: Example.

Add 25 *l.* $\frac{1}{4}$ to 12 *l.* $\frac{3}{4}$, thus: $25\frac{1}{4}$

$12\frac{3}{4}$

£. 38 Anſwer.

Here, 1 and 3, the Numerators, make 4; and $\frac{4}{4}$ is equal to 1 *l.* or an Unit: Wherefore, I carry 1 to the whole Number, ſaying, 1 and 2 is 3, and 5 makes 8; and 1 and 2 is 3; the Anſwer is 38.

III. When compound Fractions are to be added to ſimple ones, reduce the Compound to a Simple; as before directed; and then proceed as above. Example.

Add $\frac{2}{8}$ and $\frac{3}{8}$ to $\frac{1}{2}$ of $\frac{2}{4}$ of a Pound, thus: Once 2 is 2, and twice 4 is 8, the compound Fraction: Then add, ſaying, 2 and 3 is 5, and 2 is $\frac{7}{8}$, equal in Value, to 17 *s.* 6 *d.*

SUBSTRACTION of VULGAR FRACTIONS.

IN this Rule, the Fractions muſt have a common Denominator, or be reduced to one, before Deduction can be made: Example.

What is the Difference between $\frac{1}{5}$ and $\frac{4}{5}$? Anſwer, $\frac{3}{5}$; and proved by Addition: For, $\frac{1}{5}$ and $\frac{3}{5}$ make $\frac{4}{5}$.

Note, the Difference between the Numerators, is the Difference of the Fractions.

Again, from $\frac{3}{4}$ of a Pound take $\frac{5}{12}$. Here, the Fractions are to be reduced to a common Denominator, 36 the firſt Numerator, and 20 the ſecond Numerator; and their Difference is 16; and 48 is the common Denominator: So that 16 forty Eighths, or $\frac{16}{48}$, or in its loweſt Terms $\frac{1}{3}$, is the Difference between $\frac{3}{4}$, and $\frac{5}{12}$ of a Pound, that is, 6 *s.* 8 *d.*

To ſubſtract a compound Fraction from a ſimple one.

The Rule is: Reduce the compound Fraction to a ſimple one; and then work as before: Example.

From $\frac{13}{14}$ take $\frac{2}{3}$ of $\frac{8}{9}$. Say, twice 8 is 16, and 3 Times 9 is $\frac{16}{27}$, the compound Fraction; then, $\frac{13}{14}$ and $\frac{16}{27}$ muſt be reduced to a common Denominator, thus: 13 Times 27 is 351, the firſt Numerator; then you ſay, 16 Times 14 is 224, the ſecond Numerator; and 14 Times 27 is 378, the common Denominator; then ſubſtract 224, the ſecond Numerator, from 351, the firſt Numerator, and the Remainder is 127; which place over 378, the common Denominator; thus, $\frac{127}{378}$, Anſwer.

When a ſimple Fraction is to be deducted from a whole Number.

Rule: Subſtract the Numerator of the Fraction from the Denominator, and place the Remainder over the Denominator, and ſubſtract 1 from the whole Number, &c. Example,

From 12 *l.* take $\frac{5}{8}$, thus: Say, 5 (the Numerator) from 8 (the Denominator) and there remains 3, which place over the Denominator 8, thus $\frac{3}{8}$; then, 1 from 12 and there remains 11: So the Anſwer is 11 *l.* $\frac{3}{8}$, or 11 *l.* 7 *s.* 6 *d.* as may be proved by whole Numbers.

MULTIPLICATION of VULGAR FRACTIONS.

RULE: Multiply the Numerators into one another, for a Numerator of the Product; and then do the ſame by the Denominators, for a Denominator of the Product: Example.

Multiply $\frac{3}{4}$ of a Pound by $\frac{5}{6}$ of the ſame: Say, 3 Times 5 is 15, the Numerator; and 4 Times 6 is 24, the Denominator; So the Anſwer is $\frac{15}{24}$, or in its loweſt Terms $\frac{5}{8}$.

To multiply a whole Number by a Fraction.

Rule: Multiply the Integer by the Numerator of the Fraction, and place the Product over the Denominator: Example,

Multiply 56 *l.* by $\frac{3}{4}$ of a Pound; the Product whereof is 168, which being put over the Denominator 4, makes the improper Fraction $\frac{168}{4}$; which (being reduced to its known Parts) is equal to 42 *l.*

To multiply a ſimple by a compound Fraction.

Rule: Reduce the compound Fraction to a ſimple one, as before taught, and work as followeth.

Multiply $\frac{6}{8}$ of a Pound by $\frac{2}{3}$ of $\frac{3}{4}$ of a Pound: Say, 6 Times 6 is 36, and 8 Times 12 is 96: So that the Anſwer is $\frac{36}{96}$, or, $\frac{3}{8}$ in its loweſt Terms.

DIVISION of VULGAR FRACTIONS.

MULTIPLY the Numerator of the Diviſor into the Denominator of the Dividend, and the Product is the Denominator of the Quotient; and afterwards multiply the Denominator of the Dividend, and the Product will be the Numerator of the Quotient. Example.

Divide $\frac{15}{16}$ by $\frac{2}{3}$: $\frac{2}{3}$) $\frac{15}{16}$ ($\frac{45}{32}$ Quotient.

Here, 16 multiplied by 2, gives 32 for a Denominator; and 15 by 3, gives 45 for a Numerator: So that that the Quotient is equal to 1 $\frac{13}{32}$, as in the Work.

Again; ſuppoſe $\frac{24}{36}$ was divided by $\frac{2}{3}$, the Quotient will be $\frac{72}{72}$, equal to 1 Integer, or whole Thing; and ſo of any other Example.

SECTION II.

REDUCTION of DECIMAL FRACTIONS.

WHAT a decimal Fraction is, hath been already ſhewn: The next Step is, to know how to reduce a Vulgar Fraction into a Decimal; which is done by annexing Cyphers, at Diſcretion, (that is, 2, 3, or 4, &c.) to the Numerator, and then dividing it by the Denominator. Example.

Reduce $\frac{3}{4}$ of a Pound *Sterling* to a Decimal. 4)3.00(,75, that is, 75 Hundredths, equal to 3 *qrs.* of any Thing; whether Money, Weight, Meaſure, &c. as being $\frac{3}{4}$ of 100: And ſo 25 Hundredths is, in Decimals, 1 *qr.* of any Thing, as being $\frac{1}{4}$ of 100; and 5, or five Tenths, expreſſes the Half of any Thing, as being the $\frac{1}{2}$ of 10.

In Reduction of Decimals, ſometimes it happens that a Cypher, or Cyphers, muſt be placed to the Left-hand of the Decimal, to ſupply the Defect or Want of Places in the Quotient of Diviſion, or in the Product of Multiplication of Decimals. In this Caſe, always remember, That ſo many Cyphers as you annex to the Denominator of the Vulgar Fraction, ſo many Places you muſt point off towards the Left-hand; but if there be not ſo many Places to point off, then you muſt ſupply the Defect by placing 0 or 00 *s* to the Left-hand of the Decimal. Example.

Reduce 9 *d.* or $\frac{9}{240}$ to the Decimal of a Pound *Sterling*, thus:

```
24|0)9000|0(,0375
     ———
     180
     ———
     120
     ———
      ..
```

Here are but three Places in the Quotient, *viz.* 375, and therefore I cannot point off 4, for the four Cyphers annexed to 9; wherefore I prefix 0 to the Left-ſide of the Quotient 375, thus: ,0375; and then it is equal to $\frac{375}{10000}$ Parts of an Integer, as in the Work.

The more Cyphers you annex, the nearer you bring your Decimal to a Truth: But, in moſt Caſes, four are ſufficient. But when you are to reduce $\frac{1}{2}$, $\frac{1}{4}$, or $\frac{3}{4}$, as above, of an Integer to a Decimal, or any Number of Shillings to the Decimal of a Pound, two Cyphers will do. As an Example.

Reduce 3 Farthings into the Decimal of a Pound, that is, $\frac{3}{960}$, vulgarly 960 Farthings being a Pound, and therefore ſo expreſſed, and with the ſame Reaſon as 9 Pence before, 240 being a Pound.

96|0)3.00000|0(,003125. The Work being performed according to Diviſion, with two Cyphers prefixed, quotes ,003125, or 3125 ten-hundred-thouſand Parts of a Pound. By the ſame Method, the vulgar Fractions of Weight, Meaſure, &c. are reduced to Decimals. Example.

How

How is 12 *lb.* Weight expressed in the Decimal of a *C.* Weight *Avoirdupois*, or 12 *lb*? The vulgar Fractions is $\frac{12}{112}$, and the Decimal, 1071, found as before, thus: 112)120000(,1071. there remains 48, which is not worth Notice, being less than the 10000th Part of an Unit, or 1. Example.

Reduce 73 Days into the Decimal of a Year, vulgarly thus expressed $\frac{73}{365}$, and thus wrought. 365)730(,2 Answer, 2 Tenths.

VALUATION of DECIMALS.

To find the Value of a Decimal Fraction, whether of Coin, Measure, Weight, &c.

RULE: Multiply the Decimal given by the Units contained in one of the next inferior Denominations, and point off as many Places from the Right-hand, as you have in your Decimal. So, those Figures towards the Left-side of those pointed off are Integers, or whole Numbers; and those to the Right, are Parts of one or Unity, that is, so many Tenths, Hundredths, Thousandths, or ten Thousandths, &c. of one of those Integers, whether a Pound, a Shilling, or a Penny, &c. or of a Tun, an Hundred, a Quarter, or a Pound Weight, &c. And so of any other Integer, of what Kind or Quality soever. Example,

Reduce, 476 of a Pound *Sterl.* into known Value.

```
   20
 -----
 9,520
    12
 -----
 6,249
     4
 -----
Ans. 9s. 6d. 960 Parts of a Farthing.
```

```
  476 Parts of a Tun Weight.
   20 C.
 -----
 9,520
     4 qrs.
 -----
 2,080
    28 lb.
 -----
 2,240 Ans. 9C.—2qrs.—2lb. ,240.
```

In the Example of Money, I multiply the Fraction by 20, and point off 1520, for three Places in the Decimal, and the Answer is *9s. 6d.* ¼ *fere.*

In the Example of Weight, I proceed as in that of Money, (the Fraction being the same); but with different Respect to the inferior Denominations; and the Answer is *9C.—2qrs.—2lb.* $\frac{240}{1000}$ of a Pound Weight.

To find the Value of a Decimal of Money in a briefer Method, viz.

Rule: Always account the Double of the first Figure (to the Left-hand) for Shillings; and if the next to it is 5, reckon 1 Shilling; and whatever is above 5 call every one Ten, and the next Figure so many Ones as it contains: Which Tens and Ones call Farthings; and for every 25 abate one: As, admit the last Example of Money, *viz.* 476: The Double of 4 is 8; and there being one 5 in 7, (the next Figure) I reckon 1 *s.* more, which makes 9 *s.* and there being 2 in 7 above 5, they are to be accounted two Tens, or ,20; which, with the next Figure 6, being so many Ones, make 26 Farthings, and abating 1 for 25 gives 6 *d.* and almost a Farthing more.

I shall in the following Tables, in the first Column, give you the Decimals of a Pound *Sterling* from 19*s.* to 1 *s.* In the second Column, from 11 *d.* to 1 Farthing.

s.	*Parts.*	*d.*	*Parts.*	*Inch.*	*Parts.*	*lb.*	
19	,95	11	,04583	11	,9166	14	,125
18	,9	10	,04166	10	,8333	13	,11607
17	,85	9	,0375	9	,75	12	,10741
16	,8	8	,03333	8	,6666	11	,09683
15	,75	7	,02916	7	,5833	10	,08928
14	,7	6	,025	6	,5	9	,08035
13	,65	5	,02083	5	,4166	8	,07142
12	,6	4	,01666	4	,3333	7	,0625
11	,55	3	,0125	3	,25	6	,05370
10	,5	2	,00833	2	,1666	5	,04464
9	,45	1	,00416	1	,0833	4	,03571
8	,4	1*qrs.*	,00104	3*qrs.*	,0624	3	,02685
7	,35	2*qrs.*	,00208	2*qrs.*	,0416	2	,01785
6	,3	3*qrs.*	,00312	1*qr.*	,0208	1	,00892
5	,25						
4	,2						
3	,15						
2	,1						
1	,05						

In this Column, I have given the decimal Parts of a Foot in Length, from 11 Inches to ¼ of an Inch.

Here, are given the Decimals of an C. Weight, from 14 *lb.* being 1 Stone Weight, to one Pound.

For Practice; Sold 24 *lb.* of Silk at 17 *s. per lb.* Multiply 24 by ,85 being the Decimal of 17 *s.* the Product will be 2040 *l.* 40 Parts; which is the Price required.

ADDITION of DECIMALS.

IS the ſame in Practice, as in whole Numbers; only in ſetting down, care muſt be taken that the decimal Parts ſtand reſpectfully under their Parts, that is, Primes under Primes, Seconds under Seconds, Thirds under Thirds, *&c.* and the Integers to ſtand always, as in whole Numbers.

EXAMPLE.

Integers.	Primes.	Seconds.	Thirds.	Parts.	Primes.	Seconds.	Thirds.	Fourths.	Fifths.
246	,4	2	6	,4796	,4	7	9	6	2
74	,4	2		,42	,0	6	4	2	
9	,0	6		,076	,0	0	6		
65	,7	9	4	,0004	,7				
42	,0	0	5	,5	,9				
437	,7	0	5	1 ,4760	2 ,1	4	9	8	2

Note, there muſt be as many Places pointed off, as there are in the biggeſt Number.

The caſting up of the foregoing Examples, is the ſame with Addition of one Denomination in whole Numbers: The total of the firſt (ſuppoſing them Pounds *Sterling*) is 437 *l.* and ,705 Parts: The ſecond is 1 *l.* and ,4760 Parts: And the Third is 2 *l.* and ,14982 Parts.

SUBSTRACTION of DECIMALS.

THE Numbers muſt be placed, as before in Addition; and then proceed as in Subſtraction of whole Numbers of one Denomination.

EXAMPLE,

l.	*pts.*	*l.*	*pts.*	*l.*	*pts.*
49	,51	140	,42	4762	,0
9	,24	91	,7462	0	,47
37	,27	48	,6738	4761	,53

MULTIPLICATION of DECIMALS.

HERE, the placing the Numbers and Operations, is the very ſame as in whole Numbers; and you are only to remember to point off, towards the Right-hand, ſo many Places for Decimals, as you have decimal Places both in Multiplicand and Multiplyer,

Note, That where there is not a competent Number of Figures, or Places, to point off, ſuch Defect is ſupplied with Cyphers to the Left-hand; as in the laſt Example of the Work.

EXAMPLES,

24 , 6	4602	,2796	,07214
2 , 5	,075	26	,016
12 30	23010	16776	43284
49 2	32214	5592	7214
61 , 50	345,150	7,2696	,00115424

DIVI-

DIVISION of DECIMALS.

IS the ſame, in Operation, as the whole Numbers: The only Difficulty is, to know how many decimal Places to point off, towards the Right-hand of the Quotient: To which End, remember this Rule. As many Decimal Places as the Dividend contains, more than the Diviſor; ſo many decimal Places muſt be pointed off, towards the Right-hand of the Quotient: But if the Quotient ſhould be deficient of this Number of Figures, you muſt ſupply the Deficiency, by prefixing a Cypher, or Cyphers, to the Left-ſide thereof.

II. When you divide a whole Number, by a Fraction, or a mixed Number, add as many Cyphers to the Right-hand-ſide of your Dividend, as there are Decimals in the Diviſor; and the Quotient ſhall be a whole Number.

III. When you divide a Fraction, or a mixed Number, by a whole Number, you muſt increaſe the decimal Places in the Quotient, by prefixing of Cyphers before them, untill their Number be equal to the decimal Places in the Dividend.

IV. When you divide a whole Number by a whole Number, add Cyphers at Pleaſure, to the Remainder; ſtill dividing by the ſame Diviſor, and the Quotient ſhall be a mixed Number, conſiſting of as many decimal Places as there were Cyphers added to the Remainder: Examples.

(1)
Divide 12,345670 by 6,789)12,345670(1,818
55566
12547
57589
(3268)

(2)
2,34)578,00(247
1100
1640
..2

(3)
124)8,345(,067
.905
37

In Example (1) the Dividend hath three decimal Places, more than the Diviſor: Wherefore, I point off 3 Decimals to the Right-hand of the Quotient.

In Example (2) a whole is divided by a mixed Number:—And, in Example (3) a mixed Number is divided by a whole Number; and need no Explication.

I hope, this much may ſuffice, to attain a thorough Knowledge in Fractions, both *Vulgar* and *Decimal.*

CHAPTER III.

Extraction of the *Square* and *Cube* ROOTS.

SECTION I.

Extraction of the SQUARE ROOT.

WHAT may be underſtood by the Square Root, is this, *viz.* Any Number whatſoever, (whether a whole or mixt Number) being multiplied into itſelf, the Product whereof is called a Square, and the Number firſt given is called a Root; as ſuppoſe 4 were given to be multiplied by 4, the

4, the Product ſhall be 16, which is the Square of 4; and 4 is the Root of 16. Likewiſe 4 is the Square of 2; alſo 9 is the Square of 3; and 25 the Square of 5, &c. as may be ſeen in the following Table.

Squares.	1	4	9	16	25	36	49	64	81
Roots.	1	2	3	4	5	6	7	8	9

When it is required to find the Square Root of any Number that conſiſts of 3, 4, 5, 6, 7, &c. Figures, you muſt reduce them all into ſingle Squares in this Manner, *viz.*

Firſt, you muſt prick over the firſt Figure, (beginning on the Right-hand ſide), then over the third, fifth, ſeventh, &c.

Having thus prepar'd the Number given, by reducing it into ſingle Squares; look in the above Table, for the firſt Square on the Left-hand ſide of this Number, and the Fig. directly oppoſite thereto ſhall be the Root thereof; which Fig. ſo found, you muſt place firſt in your Quotient: But if it happens that none of the Squares in the Table anſwers exactly to the firſt Square of the Number given, you muſt take the Root of the Square which comes neareſt to it, for the firſt Fig. in the Quotient; which Fig. muſt be ſquared, or multiplied into itſelf; the which Multiplication muſt be ſubſtracted from the firſt Square of the Number given; then to the Right-ſide of the Remainder thereof, bring down the next Spuare of the Number given; which Remainder and Square, (being ſo placed in a continued Line, is called a Reſolvend, or Dividend; a Diviſor for which is thus found, *viz.* double the Quotient, which Double, you muſt place on the Left-hand ſide of your Reſolvend for a Diviſor; then, try how often is the ſaid Diviſor found in the Reſolvend, abating the laſt Fig. thereof, as ſuppoſe 3 Times, which 3 you muſt place in the Quotient, and alſo on the Right-hand ſide of the Diviſor; which Diviſor with the additional Increaſe of ſaid Fig. muſt be multiplied by the Fig. laſt plac'd in the Quotient, the Product whereof muſt be ſubſtracted from the Reſolvend; after the ſame manner, you muſt make a new Reſolvend, and Diviſor, for every ſingle Square in the Number given; by ſtill bringing down the Squares to the new Remainders for the Reſolvends, and doubling the Quotient for your Diviſors; as ſhall be illuſtrated by the following Example.

Let it be requir'd, to find the Square Root of this Number 54756; Firſt, reduce the Number given into ſingle Squares, which is done by pricking firſt over the firſt Fig. on the Right-hand ſide, *viz.* 6, then over 7 and 5; as you may ſee in the Margin; that done, look in the above Table for the

```
     . . .
     54756(234
  43)147
     129
     ———
 464).1856
      1856
```

firſt Square on the Left-hand ſide, *viz.* 5, which Number cannot be exactly found in the Table, therefore you muſt ſeek for the Number which comes neareſt to it, which is 4; the Root anſwering thereto is 2, which you muſt write in the Quotient; the Square whereof being Subſtracted from 5, there remains 1, to which if you bring down the next Square, *viz.* 47, you ſhall have for your Dividend or Reſolvend, 147; the next Thing to be done, is to find a Diviſor; which is thus found, *viz.* double the Quotient, which will be 4, and which you muſt write on the Left-hand ſide of your Reſolvend for a Diviſor: Then try how often is the Diviſor 4, in the Reſolvend, (abating always the firſt Fig. on the Right-hand,) which is 3 Times, which 3 write in the Quotient; and alſo on the Right-hand ſide of the Diviſor 4, which makes 43, and which being multiplied by 3, the Product is 129; which Subſtracted from the Reſolvend 147, there remains 18; to which Remainder if you bring down the next Square, *viz.* 56, you ſhall have 1856 for another Reſolvend; for which you muſt find a Diviſor, as before taught, by doubling the Quotient 23, which will be 46, and which will be found in the Reſolvend 4 Times, which you are to write both in the Quotient, and on the Right-hand ſide of your Diviſor 46, which will make 464, which multiplied by 4, the Product ſhall be 1856; the which if you ſubſtract from the Reſolvend, the Remainder ſhall be 0; So that the Square Root of 54756 is 234.

Note, if after you have extracted the Square Root of a whole Number, you have a Remainder, and are deſirous to know the Value thereof in decimal Parts; the Rule is thus, add two Cyphers to the Remainder, which you'll make into a new Reſolvend; then you muſt find a Diviſor for the ſaid Reſolvend, as if it had been a whole Number; alſo obſerve, that as many Pairs of Cyphers as you ſhall, in this Manner, add to the Remainder, ſo many decimal Places ſhall the Quotient contain. As an Example.

Let it be required to extract the Square Root of 2834, the Root of which, is 53 with a Remainder of 25 to which add 00 'twill make 2500 for a new Reſolvend, the Diviſor which is 1062 which is contained twice in the Reſolvend; having proceeded as in the Margin you have ſtill a Remainder of 376, to which if you add 00 more, you ſhall have 37600 for another Reſolvend, thus may you proceed at Pleaſure, by adding Cyphers ſtill to the Remainders; ſo you ſee by the Opera-

tion

tion in the Margin, that 53 . 23 is the Square Root, or very near, of 2834 as was requir'd. Which, for Proof, if you multiply by itself, and add the last Remainder, *viz.* 5671 to the Product; the Sum shall be equal to 2834.

```
     2834(53 . 23
     25
   103)334
       309
  1062)2500
       2124
 10643)37600
       31929
        5671
```

Note further, that when it is requir'd to extract the Square Root from a mix'd Number whose decimal Places are odd, you must reduce the said decimal Places into an even Number of Places; which is done by adding a Cypher to the Right-hand of them; because in bringing down the Squares, the integral and fractional Parts must not be confounded together in extracting either the Square or Cube Root thereof.

As no Rule in Arithmetick is more useful in all Parts of the Mathematicks than this, I have taken some Pains extroardinary to adapt my Explication thereof to the meanest Capacity of those who have any Pretension to the Study of useful Arts.

I shall here for the Satisfaction of the Reader deliver a few Questions in this Rule, the better to enable him to conceive a just Idea of the Excellency and Usefulness thereof.

I. *Quest.* There are 6241 Men to be drawn up in a Square Form of Battel; allowing each Man 3 Foot of Ground in Flank, and 7 Foot in File; 'tis requir'd to know how many Men will form one side of this Square, and how many Square Perches, at 21 Feet in Length each Perch, will the said Square of Men cover.

```
    6241(79
    49
149)1341
    1341
       0
```

First, to find one Side of the Square, extract the Square Root from 6241, which will be 79, the Number of Men that make one Side of the Square.

II. To know how many Square Perches will be sufficient for the Men to stand upon; as each is allow'd 3 Foot in Rank, and 7 in File; multiply the one by the other, and the Product shall be 21 Feet, for the Ground taken up by each Man; by which if you multiply 6241 the Product shall be 131061 Square Feet, the which if you divide by 441 the Square Feet in one Perch Square, the Quotient shall be 297 Square Perches, the Space, or Area taken up by all the Men to stand upon.

II. *Quest.* There is a Castle whose Height is 50 Feet, surrounded by a Moat or Ditch 40 Feet broad; 'tis requir'd to know how long must a scaling Ladder be, to reach from the out-side of the Moat to the Top of the Castle.

The Rule is thus: Square the Heighth 50, that is, multiply it into itself, the Product shall be 2500; also, Square 40, the Square whereof is is 1600; add these two Squares together, which make 4100, the Square Root of which, is 64 . 03 Feet, the Length of the scaling Ladder, as was required.

III. *Quest.* Suppose two Ships set Sail from one Port, the one Sails 24 Leagues due East; and the other Sails 67 Leagues due South; now 'tis required to know how many Leagues are those two Ships asunder.

The Rule is: Square each Distance Sail'd, *viz.* the Square of 24 is 576, and the Square of 67 is 4489; add these two Squares together, and their Sum is 5065, the Square Root whereof is 71, which is the true Distance of those two Ships asunder.

IV. *Quest.* Suppose a Ship sails from *Dublin*, upon a certain Rumb between the North and the East, 'till her Difference of Latitude is 90 Leagues; and Difference of Longitude 70; 'tis requir'd to know how many Leagues her Distance Sail'd is.

Square the Difference of Latitude and Longitude; add those two Squares together; the Square Root whereof is 114 Leagues, which is the Distance Sail'd.

I might have deliver'd a great many more Questions here, belonging to this Rule, to let the Reader see how various and admirable are the Uses and Performances thereof in many Parts of the Mathematicks; but my intended Brevity obliges me to Stop here, in order to proceed next to the Extraction of the Cube Root.

SECTION II.

Extraction of the CUBE ROOT.

WHAT may be underſtood by the Word Cube, is this, *viz.* the Product of any Number multiplied into itſelf is called a Square, and the ſaid Square multiplied by the Number given, whoſe Product is called a Cube, and the Number firſt given is the Root of ſaid Cube.

As an Example, ſuppoſe it were requir'd to know the Cube of 2; which is thus found, *viz.* twice 2 makes 4; ſo 4 is the Square of 2; again, twice 4 makes 8; ſo 8 is the Cube of 2; alſo 2 is the Cube Root of 8. In like manner 64 is the Cube of 4; for if you multiply 4 by 4, the Product ſhall be 16 for the Square of 4; which being again multiplied by 4, the Product is 64, which is the Cube of 4. Alſo, 125 is the Cube of 5; and 216 the Cube of 6, *&c.* as may be ſeen in the following Table.

Roots.	1	2	3	4	5	6	7	8	9
Squares.	1	4	9	16	25	36	49	64	81
Cubes.	1	8	27	64	125	216	343	512	729

Note; If you have any Number given whoſe Cube Root is requir'd to be known or found out, that conſiſts of 4, 5, 6, 7, *&c.* Figures; you muſt reduce the ſame into Single Cubes, in this Manner, *viz.* Prick over the firſt Fig. on the Right-hand ſide, then over the 4th, 7th, 10th, *&c.* Fig. Thus you ſhall have 'em reduc'd into ſingle Cubes, as the Operation in the Margin plainly ſhews, always remembring that every ſingle Cube muſt conſiſt of 3 Figures, excepting the firſt Cube on the Left-hand ſide, which may conſiſt of either 1, 2, or 3, Figures.

Having thus reduc'd your Number into ſingle Cubes, you muſt look in the foregoing Table for the firſt Cube on the Left-hand ſide of the Number given, and the Number oppoſite thereto in the uppermoſt Rank, ſhall be the Cube Root thereof; and ſhall be the firſt Fig. in the Quotient; but if it happens that you can't exactly find the ſaid Cube in the Table, you muſt take that Cube that comes neareſt to it; but never muſt exceed it, then put the Root anſwering to the ſaid Cube in the Quotient; the Cube whereof muſt be ſubſtracted from the firſt Cube on the Left-hand ſide; for the firſt Operation. Then to the Right-hand ſide of the Remainder you muſt bring down the next Cube, which jointly with the Remainder is called a Reſolvend, or Dividend; for which a Diviſor muſt be found out in this manner, *viz.* Square the Quotient and multiply the ſaid Square by 300; the Product ſhall be the firſt Member of the Diviſor; then multiply the Quotient by 30 for the ſecond Member of your Diviſor, thoſe two Sums or Members added together, ſhall be the Diviſor requir'd.

The next thing to be found is the Gnomon, Subtrahend, or Ablatitium, which is the Number to be Subſtracted from the Reſolvend or Dividend; and the Rule is thus.

Firſt, Try how many Times your Diviſor may be found in the Reſolvend, as ſuppoſe 3 Times; put 3 in the Quotient, then multiply the firſt Member of your Diviſor by the ſaid 3, the Product of which ſhall be the firſt Number, or Part of your Ablatitium; then multiply the ſecond Number of your Diviſor by the Square of 3, the Product of which ſhall be the ſecond Number or Part of your Ablatitium; laſtly, Cube the ſaid 3; which Cube, ſhall be the third Number or laſt Part of your Ablatitium; which 3 Numbers being added together, gives you the Ablatitium requir'd; which if it be equal to, or leſs than the Reſolvend, it muſt be ſubſtracted therefrom, but if it be greater, that ſhews the Fig. laaſt plac'd in the Quotient is too much, therefore you muſt put a leſſer Fig. therein, and proceed to find another Ablatitium, as before taught, which having Subſtracted from the Reſolvend; bring down the next Cube to the Right-hand ſide of the Remainder, and you ſhall have another Reſolvend; for which you ſhall find a new Diviſor, and a new Ablatitium, and muſt proceed as before taught, as may be ſeen in the next Example, *viz.*

Let it be requir'd to extract the Cube Root of 12812904.

Having reduc'd the Number given into ſingle Cubes, I find the firſt Cube on the Left-hand ſide to be 12, and as I can't find 12 exactly in the Table, I take the neareſt Cube to it, which is 8, the ſame I ſubſtract from 12, there remains 4; to which I bring down the next Cube 812 to the Right-hand ſide thereof which makes 4812; for a Reſolvend, then I put 2, being the Root of 8, in the Quotient; the Square of which is 4, which I multiply by 300, and the Product is 1200 for the firſt Member of the Diviſor; then I multiply 2 by 30, the Product is 60, which added to 1200 the Sum is 1260 for a Diviſor. Then I try how many Times is the Diviſor contained in the Reſolvend, which

is

is 3 Times; I put 3 in the Quotient, which I multiply into 1200 the first Member of the Divisor; the Product is 3600; which I write under the Divisor; next I square 3, which makes 9, by which I multiply the second Member of the Divisor, *viz.* 60, the Product is 540, which I write under 3600, then the Cube of 3 is 27, which I write under 540, those 3 Sums added together make 4167 for an Ablatitium, which I substract from the Resolvend 4812; there remains 645, to which I bring down the next Cube, 904 which makes 645904 for another Resolvend; find a new Divisor, as before taught, and is to be found, thus, the Square of the Quotient 23 is 529, which multiplied by 300 the Product is 158700 for the first Member of the Divisor; then 23 multiplied by 30, the Product is 690 for the second Member of the Divisor; these two Sums added together, gives 159390 for a Divisor; then I find that the Divisor is contain'd in the Resolvend 4 Times, therefore I put 4 in the Quotient, by which I multiply 158700 the first Member of the Divisor; the Product is 634800; then I multiply the second Member 690 by 16 the Square of 4, the Product is 11040, then the Cube of 4 is 64, those three Numbers being added together, the Sum is 645904 for the Ablatitium which being Substracted from the Resolvend there remains 0. So that 324 is the Cube Root of 12812904, as was required.

```
12812904(234
8
————
4812 Resolvend.
————
1200
  60
————
1260 Divisor.
————
3600
 540
  27
————
4167 Ablatitium.
————
645904 Resolvend.
——————
158700
   690
——————
159390 Divisor.
——————
634800
 11040
    64
——————
645904 Ablatitium.

     0
```

Note, When the Extraction of the Cube Root in whole Numbers is finished, if any thing remains, and that you are desirous to know the Value thereof in decimal Parts; add three Cyphers to the Right-hand side of said Remainder for a Resolvend; and proceed as before taught.

Note also, When a mixt Number is given, to know the Cube Root thereof, consisting of one decimal Place; you add two Cyphers to the Right-hand side thereof; if it consists of two decimal Places, one Cypher must be added; because the Cubes in the Fractional Parts must be entire; and distinct from the Cubes in the Integral Parts.

I hope what I have said here, in Relation to this Rule, (together with the Operation in the Margin) may be Sufficient to render it obvious and intelligible to the meanest Capacity.

CHAPTER IV.

Mensuration of *Superficials* and *Solids*.

SECTION I.

Mensuration of SUPERFICIALS.

I SHALL in this Chapter deliver such Directions as relate to the Measurement of Superficial and Solid Figures, and that in the plainest manner I can; and wheresoever any Fractions shall arise in the Dimensions, I shall work by decimal Arithmetick, being, both for ease and expedition, the best in Operations of this Kind.

First,

First, of the Square, *and* Parallelogram, Fig. 14. Plate I.

The Rule is this, for the Square, multiply one side into itself; the Product shall be the Content. For the Parallelogram, multiply one side by the other, the Product shall be the Content.

How to measure a Triangle, Plate I. Fig. 13.

The Rule is, multiply half the Base *b. i.* by the whole Perpendicular *e d*; or the whole Base by half the Perpendicular, the Product shall be the true Content.

Another Way, much more infallible than the first; to find the Area, or Content of a Triangle, the three Sides being given. The Rule is thus: Add the three Sides together, and take half the Sum, from which half Sum, substract each Side separately, and note the Differences; then multiply the half Sum into the said Differences continually; the Square Root of the last Product shall be the Area, or Content of the Triangle.

Let the three Sides of the Triangle given be 30, 24 and 18; the Sum of these three Sides added together is 72, one half of which is 36; the Differences are 6, 12 and 18; which being multiplied into 36 continually, the Product is 46656, the Square Root whereof is 216, the true Area or Content of the Triangle, as was required.

This is a most exact Way for Surveying of Land.

How to measure an Hexagon. Fig. 20.

Let the Hexagon given be *a, b, c, d, e, f*; First from the Centre *o* let fall the Perpendicular *o p*. by which if you multiply half the Base *a, b*, you have the Content of the Triangle *a o b*; which, if you multiply by 6, the last Product shall give you the Content of the Hexagon as was requir'd; after the same Manner may be measured all sorts of regular Polygons.

When you have an irregular Polygon to be measur'd, you must reduce it into Triangles, then find the Content of each Triangle, as before taught, which added together gives the true Content of the irregular Fig. See Plate I. Prob. 28.

This may suffice for the Measurement of all Varieties of plain-sided Figures; now I shall proceed to the Measurement of a Circle, which is a plain Figure contained within one Line only; in the Midst whereof there is a Point called the Centre, from whence all Lines drawn or carried to the Circumference are equal, so A B is equal to A *n* Plate I. Fig. 11.

The Proportion that the Diameter of any Circle hath to the Circumference, is as 7 to 22, or (more exactly) 113 to 355.

To find the Area or superficial Content of any Circle, the Rule is thus: Square the Diameter (which is to multiply it into itself) multiply the said Square by 11, and divide the Product by 14, the Quotient shall be the Content of the Circle requir'd.

How to measure an Ellipsis, *or* Oval. See Plate I. Fig. 29.

The Rule is thus. Multiply the Diameter A B into the Diameter C I, extract the Square Root from the Product, which shall be equal to the Diameter of a Circle, whose Area is equal to the Area of the Oval given: Then proceed as before taught in measuring of a Circle.

SECTION II.

Mensuration of SOLIDS.

AND first, of a Cube, see Bottom of Plate I. Fig. A, B, C, D, *&c.* A Cube is a Solid Body, consisting of six square Faces; Planes, whose Sides are all equal, and Angles, all Right ones, and hath for its Dimensions, Length, Breadth, and Depth, as the Fig. A sheweth; and the general Rule for Measuring the same is, multiply one Side into itself, and the Product multiplied by the Depth, shall give the Solid Content of the Cube as was required. For the long Cube B, multiply one of the long Sides by the short Side, that Product multiplied by the Depth gives you the Solid Content of the long Cube as was required.

To measure a Priamis *or* Cone.

The Solidity whereof is found after the same Manner, *viz.*

First,

First, find the Area of either of the Bafes C or D which if you multiply by $\frac{1}{3}$ of the Altitude, the laft Product is the Content.

To measure a Prifm, *or* long Triangular Solid.

First, find the fuperficial Content of one End, which is a Triangle, as before taught, which multiplied by the Length, the Product is the Solidity required.

Suppofe there is a Solid Body as F, to be meafur'd, whofe Bafes at both Ends are regular Pentagons, both equal.

First, find the fuperficial Content of one of the Bafes; which if you multiply by the Length, the Product fhall be the Content.

To meafure an Irregular Solid *as* G, *whofe Ends confift of unequal* Sides *and* Angles.

First, find the Area of the Bafe (as is before taught in Meafuring an irregular Polygon) which if you multiply by the Length, the Product fhall be the Content.

To meafure a Cylinder, *and find the Superficial Content thereof.*

First, find the Area of one End, (as before taught in Meafuring of a Circle) which multiplied by the Length, gives the Solid Content. To find the Superficial Content, the Rule is thus, multiply the Length by the Circumference, and to that Product add the Areas of both the Ends thereof; the Sum fhall be the Superficial Content required.

To find the Superficial *and* Solid Content *of a* Globe.

First, for the fuperficial Content, multiply the Diameter, by the Circumference, and the Product fhall be the fuperficial Content required.

2. To find the Solid Content; Cube the Diameter, which multiplied by 11, if you divide the Product by 21; the Quotient fhall be equal to the Solidity required.

To Meafure Timber *with* unequal Bafes, *or* Fruftrums *of* Piramids, Cones, *&c.*

First, find the fuperficial Content of each End of the Fruftrum. Secondly, multiply the fuperficial Content of one End by the other, and extract the fquare Root of their Product. Laftly, this fquare Root being added to the Sum of both Areas at the Ends, and their Sum multiplied by $\frac{1}{3}$ of the Length of the Fruftrum, the Product fhall be the folid Content required.

CHAPTER V.

Of GEOMETRY.

SECTION I.

Definitions of LINES and ANGLES.

I. A POINT, is that which is confidered as having no manner of Dimenfions, *i. e.* of Length, Breadth, or Depth; being perfectly indivifible, as the Point A.

II. From the Motion of a Point is generated a Line, which is called a Quantity of one Dimenfion; becaufe it may have any Length, but no Breadth or Thicknefs, as the Line A———B made by the Motion of the Point A, going forward to B.

III. Of Lines, there are two Sorts, *viz.* ftreight and crooked, or curved Lines.

IV. A ftreight or right Line, is the neareft Diftance between any two Points, as A———B, Plate I,

V. A crooked or curved Line, is that which lies bending between thoſe two Points, which limit its Length, C D, or E F. See Plate I. Fig. 1.

VI. Parallel Lines, are thoſe which lie equally diſtant from each other in all their Parts, and, being continued infinitely, wou'd never meet or croſs one another in any Point, as the Lines A B and *a b*, or C D and *c d*. Fig. 2.

VII. Any two ſtreight Lines falling one upon the other, conſtitute or form what *Geometricians* call an Angle; as the Lines A B, and A C, the meeting whereof, *viz.* at A, is the Angular Point, and is ſaid to be leſs, or greater, as the Lines, by which it is made, are nearer or wider aſunder: whether the Lines, which include the Angles, be long, or ſhort, thus, the Lines A *b*, and A *c*, include the ſame Angle, as A B and A C, notwithſtanding they are ſhorter, and this ſhou'd be carefully heeded, becauſe it is a Miſtake which young Beginners are apt to fall into. Fig. 3. But to make it more plain,

Let them imagine the Angle A to be laid upon B, as the prick'd Lines about B do repreſent Fig. 4. then it is evident, the Angle B will be eaſily contain'd within A, and therefore is leſs than A, by how much its Legs come nearer, or are more inclined towards each other, than thoſe of A; and conſequently A will be a greater Angle than B, becauſe its Legs are farther diſtant aſunder, than the Legs of B.

VIII. Angles are of three Kinds, *viz.* A Right Angle, an Abtuſe Angle, and an Acute Angle; Note, the two laſt are in general term'd Oblique.

IX. A Right Angle is at the meeting of two Right Lines, when one falls upon the other ſo directly, as that it neither inclines, nor declines from one Side more than the other; which Lines, ſo meeting, are ſaid to be Perpendicular to each other. Thus, the Lines *a c*, and *c b*, are Perpendicular to *c d*, as well as *c d* is to either, or both of them; and the Angles *o* and *u*, are both Right Angles. See Fig. 5.

X. An Obtuſe Angle, is that which is greater than a Right Angle; and ſuch is the Angle at *a* Fig 6.

XI. An Acute Angle, is that which is leſs than a Right Angle; ſo the Angle *b* is ſaid to be Acute.

XII. An Angle is uſually repreſented by three Letters, whereof the middlemoſt always ſignifies the Angular Point; as the Angle *a, b, d* is the Angle which by the Lines *b. a* and *b d* is at the Point *b*. Fig. 7. or thus expreſſed *a (b) d*.

XIII. An Arch of a Circle, is the Meaſure of an Angle, being deſcribed upon the Angular Point, ſo the Meaſure of the Angle *c (b) e*, is the Arch *c e*.

Of a CIRCLE.

XIV. BECAUSE a Circle is a plain regular Figure, which by one continued Line called the Circumference or Periphery, does circumſcribe a certain Space, and ſet Bounds or Limits thereunto, as the Fig. B. It will I conceive, be convenient, before we go any farther, to ſay ſomewhat briefly of Superficies in general; which Mr. WARD, in his *Introduction to the Mathematicks*, Page 285. defines thus.

XV. A Superficies or Surface, is the upper, or very outſide of any viſible Thing. But by Superficies in Geometry, is meant, only ſo much of the outſide of any Thing, as is incloſed within a Line, or Lines, according to the Form or Figure of the Thing deſigned; and is produced or found by the Motion of a Line; as a Line is deſcribed by the Motion of a Point, thus,

Suppoſe the Line A B Fig. 9. were equally moved (upon the ſame Plane) to C D, then will the Points at A and B deſcribe the two Lines A C and B D; and by ſo doing, they will form and encloſe the Superficies, or Figure A B C D, a Quantity of two Dimenſions, to wit, Length and Breadth, but not Thickneſs; conſequently, the Bounds or Limits of a Superficies are Lines.

Note, the Superficies of any Figure is uſually call'd its Area.

Note alſo, that the Line E B in the Figure above, is called the Radius, or Semidiameter; the End whereof, *viz.* at the Point B, is the Centre of the Circle.

From the foregoing Definition of a Circle, it will, with a very little Conſideration, be evident, that all Right Lines drawn from the Centre to the Circumference are equal; becauſe they are all Radius's.

XVI. The Diameter of a Circle is a Right Line drawn through the Centre to either ſide of the Circumference, dividing the Circle into two equal Parts, and is equal to twice Radius, as the Line A B D; hence it is plain, that Circles which have one, and the ſame Radius are equal; for equal Radius's muſt deſcribe equal Circles. Fig. 10.

XVII. A Semicircle (or half Circle) is a Figure included between the Diameter, and that Part of the Circumference which lieth on one Side thereof, as A E D.

XVIII.

XVIII. A Quadrant is half a Semicircle, or one Quarter of the whole Circle, and is the Meaſure of a Right Angle; thus, the Lines B E and E D do contain ¼ Part of the Circle A E D F; which is alſo the Meaſure of the Right Angle E B D.

XIX. A Segment, Section, or Portion of a Circle, is a Figure contained under one Right Line, and a Part of the Circumference, either greater or leſs than a Semicircle, as the Fig. D G E or D F E, Fig. 11.

XX. A Sector is a Figure included between two Right Lines or Radius's of the Circle, and an Arch of the Circumference, cut by the ſaid Lines; or it is an Angle at the Centre contain'd under two Semi Diameters and Part of the Periphery, as A *m n* Fig. 11.

Here *Note*, the Circumference of every Circle, great or ſmall, is ſuppos'd to be divided into 360 equal Parts, call'd Degrees; and every of thoſe Degrees are again ſuppoſed to be divided into 60 other Parts, called Minutes, &c. So that,

A Semicircle contains 180 Degrees, and a Quadrant 90 Degrees.

Of TRIANGLES.

As there are are three ſeveral ſorts of Angles, as has been already ſhewn, (by Def. VIII.) ſo there are alſo many Kinds of Triangles, which borrow Names, either from their Sides, or Angles, as we ſhall make appear, when we have firſt given the Definition of a Triangle.

XXI. A plain Triangle, is a Figure terminated by three Right Lines (and no more) making as many Angles; and ſuch is A Fig. 12.

Where *Note*, that every Triangle conſiſts of three Sides, and three Angles.

Triangles which are diſtinguiſh'd in reſpect of their Sides are theſe.

1. An Equilateral Triangle, whoſe Sides are all equal, and whoſe Angles contain each 60 Degrees as A Fig. 12.

2. An Iſoſceles, or Equicrural Triangle, whoſe two Sides only are equal as B.

3. A Scalenous Triangle, which hath all its three Sides unequal, as C.

Triangles, which are diſtinguiſhed in reſpect of their Angles, are thoſe.

XXII. A Right Angled Triangle, which hath one Right Angle as D, whoſe Angle at *a*, is a Right Angle; *i. e.* it contains juſt 90 Degrees.

XXIII. An Abtuſe Angled Triangle, call'd alſo an Amblygonial Triangle, which hath one of its Angles obtuſe, or blunt; *i. e.* greater than a Quadrant, or 90 Degrees, as the Angle *o* in Fig. C.

XXIV. An Acute Angled Triangle, call'd likewiſe an Oxygonial Triangle, whoſe three Angles are all Acute or Sharp, *i. e.* leſs than 90 Degrees, and ſuch is the firſt Triangle A.

Note here, as before of Angles, that the two laſt of theſe are in general Terms call'd Oblique Triangles.

The Perpendicular Height, or Altitude of any plain Triangle, is the Length of a Right Line let fall from one of its Angles to a Point directly oppoſite thereto in one of its Sides, produced, if need be. See the pricked Lines in Fig. 13.

Of QUADRILATERAL or four-ſided FIGURES.

XXV. A Square is a plain regular Figure, whoſe four Sides are all equal, and its Angles, right Angles, as A Fig. 14.

XXVI. A Rectangle, or a right angled Parallelogram, call'd alſo an Oblong, and ſometimes a long Square, is a Figure whoſe Sides are unequal, but its Angles all right, as B.

XXVII. A Rhombus, or a Diamond-like Figure, is that which hath equal Sides, but unequal Angles, as C. Fig. 15.

XXVIII. A Rhomboide hath both its Sides and Angles unequal as D.

XXIX. The Perpendicular Height, or Altitude of any oblique angled Parallelogram, *viz.* either of the Rhombus, or Rhomboides, is the ſame as above in *Def.* 24, of a plain Triangle, &c. as is evident by the prick'd Line in E Fig. 16.

XXX. All four-ſided Figures, which fall not under the Conſideration of one or other of thoſe fore-named, are called Trapezia, or Table-Forms, that is, when neither their oppoſite Sides nor Angles are equal, as Fig. 17.

XXXI. A right Line being drawn from any Angle in a Trapezium to its oppoſite Angle, is call'd a Diagonal, and will divide it into two right lined Triangles, *viz.* F and *g*.

XXXII. All right lined Figures of more than four ſides, whether regular, or irregular, are in general term'd Polygons, *i. e.* having many Corners; for ſo the Word ſignifies.

XXXIII. A regular Polygon, is that whoſe Sides and Angles are all equal one to another, as H Fig. 8.

XXXIV.

XXXIV. An irregular Polygon hath both its Sides and Angles unequal, as I Fig. 19.

Of this kind of Polygons, there are infinite Varieties; but of the other, *viz.* the regular Polygon, there are usually reckon'd Six, which for Distinction's sake, are named according to the Number of Sides, (or Angles,) thus, if it hath

5 Sides it is called.	A Pantagon.
6	An Hexagon.
7	An Heptagon.
8	An Octagon.
9	A Nonagon.
10	A Decagon.

Note. all regular Polygons, (how many soever the Sides and Angles are,) may be inscribed within a Circle, *i. e.* their angular Points will all just touch the Circle in the Circumference, and all Polygons whatever may be divided into Triangles, by drawing Lines from a Point within to every Angle; or from any one Angle to all the rest.

But in this last Case, the Number of Sides will always exceed the Number of Triangles drawn within the Area by 2, which in the other will be just equal thereto, as the pricked Lines in Fig. 18, and 19 will clearly demonstrate.

XXXV. The Angles of the Polygon taken all together, will make twice as many Right ones, wanting four, as the Figure hath Sides; thus, for Instance, if the Polygon has six Sides, the Double of that is 12, from which substracting 4, there will remain 8, now I say, that all the Angles of that Polygon, *viz.* *a, b, c, d, e, f,* taken together, are equal to 8 right Angles; which will appear very plain, if we consider, that the Lines *a, b, c, d,* &c. do divide the Figure into six Triangles; the three Angles of each of which, are equal to two right Angles; (as shall be made obvious, when we come further on,) consequently all their Angles taken together, make 12 right ones. But now each of these six Triangles, hath an Angle at the Centre (o) and from thence they compleat the Space all round the said Point; all which Angles taken together, are equal to four right Angles; which is the same as to say, they are all equal to four Quarters of a Circle. Now, each Quadrant, or fourth part of a Circle, contains just 90 Degrees, or a right Angle, as you have before learn'd. Consequently they must be equal to four right ones; for so many right Angles do also compleat a Circle: Wherefore those four being taken from twelve, the Sum of the right Angles of all the six Triangles, there remains 8, the Sum of the right Angles of the Hexagon, which make in all 8 Times $90=720$ Degrees; and therefore, every Angle must be equal to $\frac{1}{6}$ of that, *viz.* 120 Degrees.

So that 'tis plain the Figure hath twice so many right Angles, as Sides, wanting four, which was what we undertook to prove.

SCHOLIUM.

From a serious Consideration of the foregoing Premises, we may draw this undeniable Conclusion, *viz.* that all the external or outward Angles of any right-lined Figure, are equal to just 4 right ones. And this, though it be plain enough to those who have but little skill in Mathematics, I shall, notwithstanding, for the Sake of the Unlearn'd, make appear by a new and easy Method, which serves to prove the Truth of many useful Propositions in EUCLID, and other famous *Geometricians*; as the Reader will perceive hereafter.

Let us then, for Instance, suppose the Sides of the irregular Polygon *a, b, c, d, e,* Fig. 21. to be lengthened out by pricked Lines, equal to the Radius of the Circle (*g*) or of any other, and that with the same Radius there be describ'd the several Arches *l, m, n, o, p,* from the angular Points of the Polygon, *viz.* *a, b, c, d, e.*

Now, because every whole Circle is the Measure of four right Angles, (or 360°) which I wou'd have the Reader to remember, I say therefore, that those pricked Arches being taken severally between the Compasses, beginning at *a*, and applied from *f*, to the several Marks on the Circle *b*, will exactly measure the whole Circumference, as any one may by trial, find. Consequently, all the external Angles are equal to four right ones, which was to be proved.

SECTION II.

Preparatory Problems; or the Rudiments of plain and Practical GEOMETRY.

BEFORE I begin the Work of this Section, it may not be amiss to explain some of those general Terms commonly made use of by *Geometricians*, &c. which are as follows.

I. A *Problem*, is that which relates to Practice, requiring something to be done; as to bisect a Line given, to draw a Circle through any three Points, *&c.* and does more immediately belong to Practical, than speculative Geometry.

II. A *Theorem*, is a Mathematical Declaration of certain Properties, Equalities, or Proportions, duly inferred from some Suppositions about Quantity, that is, it does not require any Thing to be done; but only declares, that if such an Operation be performed, from thence there will arise such and such Properties, *&c.* as if two Lines intersect or cut each other, the two opposite Angles will be equal, *&c.*

Note, *Euclid*, and some others include both these under the general Term of Proposition.

III. A *Reciprocal Theorem*, is that whose Converse, or Contrary is true.

IV. A *Corollary*, is a Consequence or Deduction from a foregoing Argument or Proposition, or from something that has been already proved or demonstrated.

V. A *Lemma*, is a Proposition which serves previously to prepare the way for a Demonstration or Proof of some *Theorem*; or the Construction of some Problem.

VI. A *Scholium*, is a brief Remark or Observation on any Proposition, or precedent Discourse.

VII. As to *Axioms*, *Postulates*, or *Petitions*, they signify only such easy and self-evident Principles as need no Explication, or Illustration, to render them intelligible to those who have in the least consider'd them, and such are those that follow.

Postulates, or Petitions, *being the Ground-work of all that is contained in this Chapter.*

I. THAT a right Line may be drawn from any one given Point to another.

II. That a right Line may be continued to any Length whatever.

III. That upon a given Point, or Centre, a Circle may be describ'd at any Distance required.

I do here advise the young Learner to acquaint himself with the Signification of the following Signs, or Characters, not only because they will very much shorten the ensuing Work, as being a clearer, bettter, and more significant Way of denoting what is to be done in most Conclusions, than can otherwise be express'd in Words at length. But also, for that being used by many of the best *Authors* in the Mathematicks; it will be a good Introduction and Help to the Understanding of their Work.

An Explication of the CHARACTERS.

+ PLUS, or more; the Sign of Addition, as $a+b$, is a added to b.

— Minus, or less; the Sign of Substraction, as $a-b$, is a less by b, or b Substracted from a.

× *into*, or *with*, the Sign of Multiplication, so $a \times b$, is a multiplied by b.

÷ *By*, the Sign of Division, so $a \div b$, is a divided by b. also $a)b($ or thus $\frac{b}{a}$ all which signify the same Thing.

= *Equal*, the Sign of Equality, or Equation, so $a = b$, is a equal to b. :: *So is*, the Sign of Proportion, as $a : b :: c : d$, signifies as a is to b, so is c to d. This Sign is always put between the two Middle Numbers (or Quantities) in any Proportion.

$\angle$, denotes an Angle, and $\angle$'s signify Angles.

∟, a right Angle; △ a Triangle; □ a Square; and ▭ a Parallelogram or long Square.

These Signs and their Significations being perfectly learned, the Learner may proceed, with the same Ease and Pleasure, as if all had been express'd in Words at large. See Plate I. Prob. I.

PROBLEM I.

Two right Lines; A and B, being given to find their Sum and Difference. *(Euclid* 1. 31.*)*

Make the shortest Line, B, Radius, and therewith describe the Arch D B, from the Centre (c), of which set off the other Line A, and join both in a right Line: Then will A B = A+B: and A D = A—B; which was required.

PROBLEM II.

To divide a right Line, as A B, into two equal Parts. *(Euclid* 1. 10.*)*

On the Points A and B, with any Distance greater than ½ the Line A B describe the two prick'd Arches, cutting one another in the Points C D; from whence, if you draw the Line C D, it shall exactly divide the Line A B in the Middle at E, that is, A E will be equal to E B, as was required. See Plate I. Part II.

PROBLEM III.

To a right Line given, as A B, to draw a Parallel Line C D that ſhall paſs through any aſſigned Point, as at *e*, that is to ſay, at any diſtance required. *(Euclid* 1. 31.*)* See P. 3.

Take any convenient Point in the given Line A B, as ſuppoſe at F; for the farther from *e* the better; make *e* F Radius, and with it deſcribe the Semicircle G H *e* M, then make the Arch G H equal to M *e* and through the Points H and *e*, draw the Line C D; it ſhall be the Parallel Line required.

PROBLEM IV.

To raiſe or let fall a Perpendicular as A D, to a right Line N O, from a Point given above, or beneath the ſame, as D, or G. *(Euclid* 1. 12.*)*

Upon the given Point D at any convenient Diſtance, more than half N O, deſcribe the under Arch *e f*, cutting the Line N O in the Points *e* and *f*, then if you divide the Space between the two Points *e* and *f*, (by Prob. 2.) in the Middle, as at A, and draw the right Line A D, it ſhall be the Perpendicular required.

The like Conſtruction may be uſed, if the Point were beneath the given Line N O, as P. 4. plainly ſhews.

But if it had been required to erect a Perpendicular from the Point A upon the Line N O; then upon the Points *e* and *f*, or any other equal Diſtances from A, on both Sides, deſcribe two arch Lines, croſſing each other in D; from which Point D, if you draw a Line to A, it will be Perpendicular, *&c.* as was required.

PROBLEM V.

To erect or raiſe a Perpendicular upon the End of any right Line given, as at A. P. 5. *(Euclid* 1. 11.*)*

Open the Compaſſes to any convenient Diſtance, and ſetting one Foot in the Point B, with the other draw the Circle A C E D, but ſo as it may always go thro' the Point, whence the Perpendicular is raiſed; then lay a Rular from C to B, and draw the Diameter of the Circle; ſo ſhall you have the Point D given; from which Point D, to A, if you draw the right Line A D, it will be the Perpendicular required.

PROBLEM VI.

To divide a right-lined-Angle given into two equal Parts. *(Euclid* 1. 9.*)*

Upon the angular Point, as at O, p. 6. with any convenient Diſtance, deſcribe the Arch E F, and from F and E draw the arch Lines F *f*, and E *e*, croſſing each other, as at C, then thro' the Interſection of thoſe two Arches, draw the Line C O, and it will biſect the Arch F E, and conſequently the ∠; as wasrequired.

PROBLEM VII.

To divide a right Line given, as O P, P. 7. into any Number of equal or unequal Parts, or like to any other right Line propounded *(Euclid* 6. 10.*)*

Upon any right Line drawn at Pleaſure, as the prick'd Line L M, with any ſmall opening of the Compaſſes, meaſure the ſame any Number of Times, (ſuppoſe 5) then take the Diſtance from A to 5, and make therewith an Equilateral △, as A L M, (by Prob. 9.) again take in your Compaſſes the given Line O P, and ſet it from A to *n* and *r*; then if you lay a Rular from A to the ſeveral Points 1, 2, 3, 4, in the Line L M, it will cut the given Line O P in the Points 1, 2, 3, 4, dividing it into 5 equal Parts as was required.

And thus may this equilateral △ be fitted for dividing any other Line greater or ſmaller, as F H, and F S, into 5 equal Parts, as the prick'd Lines in the Figure will demonſtrate; the ſame muſt be done, if the Parts had been unequal; but this is ſo plain, that it is needleſs to ſpend more Time about it.

PROBLEM VIII.

To protract or lay down an ∠ of any Quantity of Degrees, or make an ∠ equal to an ∠ given. *(Euclid* 1, 23.*)*

Let the ∠ given be 40 Degrees; firſt, with any Radius on the Point C. P. 8. deſcribe the Arch *a*, *o*, the Meaſure whereof let be 40 Degrees, then through the Point *o* draw the Line C *o*, and it is done.

Thus may any other ∠ be made like unto it, by uſing always the ſame Radius; for then, if the Arches be equal, the ∠'s will be the ſame alſo.

PRO-

PROBLEM IX.

To defcribe an equilateral △ upon a right Line given. *(Euclid* 1. 1.*)*

Take the given Line A B, P. 9. in your Compaffes, and placing one Foot in A and B, defcribe the two prick'd Arches croffing each other in the Point *x*, with right Lines; and they will form an Equilateral △, as was required.

PROBLEM X.

Three right Lines being given, to make thereof a △, (provided the two fhorteft of them, taken together, be longer than the Third.) *(Euclid* 1. 22.*)*

Let the longeft Line be A B, and the two fhorteft L I. With the Line I in your Compaffes fet one Foot in A, and with the other make an Arch; then with the Length of the Line L in your Compaffes, fet one Foot in B with the other make another Arch croffing the former Arch in C, then draw the Lines A C, and B C, fo is the △ compleated, as was required.

PROBLEM XI.

A right Line as A B (P. 11.) given; to make therewith a true Geometrical Square. *(Euclid* 1. 46.*)*

Upon one End thereof, as at B, erect the Perpendicular B C, of the fame Length with A B, and with that Diftance, fix one Foot of the Compaffes in C and A, draw the fmall Arches croffing each other in the Point D; join A D, and C D with right Lines, and they will conftitute the Square; as was required.

PROBLEM XII.

Two unequal right Lines being given, to make thereof a right Angled Parallelogram Square.

Upon one End of the longer Line, as at C, (P. 12.) erect a Perpendicular of the fame Length with the fhorteft Line D C, then make A C and D C, Radius, and defcribe therewith, from the Points D and A, the two pricked Arches croffing each other in E; join A E and D E with right Lines, fo fhall you have the Parallelogram, or Oblong, required.

PROBLEM XIII.

Any right Line being given, to form, or make thereof, a Rhombus, or oblique angled Parallelogram. *(Euclid* 1. 1.*)*

This Figure is no other than two equilateral △'s join'd Bafe to Bafe, as the prick'd Line *c. d.* P. 13. plainly fhews, and might be made or defcribed after the fame manner, *viz.* (by Prob. 9.) Or thus, make the given Line *c d* Radius, and on each End thereof defcribe an Arch, which being continued 'till it meets with the other Arch in the Points *a* and *b*, fhall give the Length of the Rhombus fought; and if you divide the two Arches in the Middle, which is done with the fame Radius, it will help you to the Breadth thereof; *viz. c d*; and thus have you found four Points, from which drawing right Lines, they will repeat the Figure required.

PROBLEM XIV.

To defcribe a Rhomboide according to two Lines given.

Let the two Lines given be A and B, P. 14; firft, fet down the Line A, then with the length of the Line B in your Compaffes, fixing one Foot in C with the other make the Mark D; your Compaffes ftill unalter'd, fixing one Foot in A make the Arch *e f*, then with the Length of the Line A in your Compaffes fixing one Foot in D, with the other defcribe the Arch *d e*, then draw the right Lines A *o* and D *o*, which will compleat your Rhomboide, as was required.

PROBLEM XV.

A right Line as A B, being given to divide the fame according to any Proportion affigned; fuppofe, as C is to D. *(Euclid* 6. 10.*)*

Make any ∠ with the given Line A B, P. 15, then fet the Line C from A to *n*, and the Line D from *n* to *b*; and draw *n* L parallel to *b* B, (by Prob. 3.) fo fhall the Point L divide the Line A B in the Proportion required; that is to fay,

As C : D : : A L : L B. for C+C=D; fo alfo A L+A L=L B, and, much after the fame way, you may cut off from the given Line A B, or any other, what Number of Parts you pleafe, as for Inftance, fuppofe $\frac{2}{5}$,

Make any ∠ with the given Line A B, as before, and let A *b* be made equal to 5 Parts taken from any Scale of equal Parts, then fet two fuch Parts from A to L, join *b* B, and draw *n* L parallel to it: So is A L=$\frac{2}{5}$ of A B, as was required. *(Euclid* 6. 9.*)*

PRO-

PROBLEM XVI.

Any two right Lines, as A and B, being given, to find a third proportional to them: (*Euclid.* 6 11.)

Make an ∠ at Pleaſure, and from the Vertex, or top thereof A. P. 16. ſet the two given Lines A and B, from A to *m* and *n*, and draw *m. n*; place alſo the Line A from A unto *d*, and draw *c d* parallel to *m n*, (by Prob. 3.) So is *a c* the Line ſought. For as *b* : *a* :: *a* : A *c*.

PROBLEM XVII.

Any three right Lines, as A, B, C, given, to find a fourth proportional to them: Or, to work the Rule of Three by Lines. (*Euclid* 6. 12.)

Make any ∠ as before, P. 17. and from the Point D, ſet the two firſt Lines A and B to *o* and *n*; then ſet the third Line C from *d* to *o*, draw the Line *o, n*, and thro' the Point *e*, draw *e r* parallel thereto: (by Prob. 3.) So is D *r* the fourth Proportional ſought. For, As A : B :: C : D *r*. Or as 8 : 12 :: 16 : 24.

PROBLEM XVIII.

Two Lines A and B given, to find a mean Proportional between them. (*Euclid* 2. 14.)

Note, a mean Proportional between any two Lines, or Numbers, is that which bears the ſame Proportion to a third Term, that the firſt bears to the ſecond.

Join A and B (P. 18.) in a right Line, as *n, o*, on the Middle whereof, as at D, deſcribe the Arch *n* C *o*; and from F, the Point of Contact, or meeting of the Lines A and B, erect the Perpendicular F C, which ſhall be the mean proportional Line required. For, F C X F C=AXB, that is, the Square of any mean Proportional Line, is always equal to the Rectangle, or Product of the two Extremes.

PROBLEM XIX.

To deſcribe a Circle that ſhall paſs thro' any three Points, not lying in a right Line, as A, B, C.

Join the Points B A and B C with Right Lines; (P. 19.) then (by Prob. 2.) biſect or divide thoſe Lines in the Middle, and continue to draw the biſecting Lines till they meet each other: So ſhall the Point of Interſection D give you the Centre of the Circle required.

Hence 'tis eaſy to find the Centre of any given Circle, if three Points be take any where in the Circumference; or, by having a Segment, or part of any Circle, to compleat or deſcribe the whole.

PROBLEM XX.

To find two right Lines that ſhall bear ſuch Proportion to one another as two given Squares, *viz.* B and C. (*Euclid* 6. 4.)

Continue D E, the Side of the greater Square, until it be equal to F E, the Sum of the Sides of the given Squares B and C, then draw the Line F G, ſubtending the right ∟ D, from which let fall the Perpendicular D *b* cutting F G in the Point *b*; ſo is F *b* and *b* G, two Lines in like Proportion to each other, as the given Squares B and C, as was required.

This Problem might have been otherwiſe perform'd, by finding a third Proportional between the two Sides F D and D E, (by Prob. 16.) which ſhou'd have like Proportion to either of them, as the given Squares.

And thus may you, at any Time, find two Lines bearing ſuch Proportion to each other, as any two Figures whatever, reducing them firſt into Squares, as you are hereafter directed, (by Prob. 27.) then proceeding by either of the foregoing ways.

PROBLEM XXI.

Two right Lines O and B, bearing any Proportion to each other, being given, to make two like Figures which ſhall be in the ſame Proportion one to the other.

This Problem is, in all reſpects, performed the ſame way with Problem 18. foregoing; as P. 21, will ſufficiently declare, in which, the two Lines C *n* and C *o*, being found in the ſame Manner, as is there ſhewn, repreſent the Sides of two equilateral △'s, or of two Squares, or other-like Figures, or the Diameters of two Circles bearing ſuch Proportion to each other as the given Lines O and B, as was demanded.

PROBLEM XXII.

Upon a right Line, as A C given, to deſcribe a △ ſimilar, or in all reſpects like to another △. (*Euclid* 1. 37.)

Make the ∠'s A and C (by Prob. 8.) equal to the ∠'s D and E in the given △, and draw the Sides A B and C B until they meet each other; ſo ſhall the △ A, B, C, be in all Reſpects like unto the

the △ D, F, E, that is the ∠'s of the one will be equal to the ∠'s of the other, and their Sides alike Proportional, as was required. See P. 22.

This Propoſition is of ſo great Uſe in the Mathematics, that it may paſs for a moſt univerſal Principle, in taking all manner of Dimenſions; and were one but to unfold all the Uſes of it, it wou'd be neceſſary to tranſcribe *Euclid*'s whole firſt Book of practical Geometry.

PROBLEM XXIII.

In any given Circle to inſcribe a △ whoſe ∠'s ſhall be equal, and Sides proportional to another given △, *viz.* A, B, C, *(Euclid* 4. 2.*)*

Draw any right Line as D E, ſo as juſt to touch the Circle, as at F; upon which Point F, make the ∠'s D F G, and E F I, equal to the ∠'s B C A, and B A C, of the given △ (by Prob. 8.) and draw the Line G I; ſo ſhall the △ G F I, be equiangular, and conſequently the Sides proportional to the given △ A B C, as was required. See P. 23.

Note, A right Lined Figure is ſaid to be inſcribed in a Circle, when all its angular Points do but juſt touch the Circles Periphery, or Circumference.

PROBLEM XXIV.

About a Circle given to deſcribe a △ which ſhall be Similar, or alike in all Reſpects to another △, as A B C. *(Euclid* 4. 3.*)*

Continue the Baſe A B, of the given △ both ways to any convenient Length, *viz.* to D and E, making the two outward ∠'s D A C and C B E, then from the Centre of the given Circle, draw any Radius, as F G, and make the ∠'s *l* F G, and *m* F G, equal to the ∠'s D A C, and C B E, of the given △; (by Prob. 8.) and through the Points *l*, *m*, and G, draw ſtraight Lines at right ∟'s with the ſeveral Radius's *l* F, *m* F, and G F, 'till they interſect or meet each other, ſo ſhall you have the △ H I K like unto the given △, and alſo deſcribe about the Circle, as was required. See P. 24.

PROBLEM XXV.

In any given △, as A B C, to deſcribe a Circle that ſhall juſt touch all its Sides. *(Euclid* 4. 4.*)*

Biſect or divide any two ∠'s of the △ (by Prob. 6.) and where thoſe beſecting Lines meet, as at D, will be the Centre of the Circle required.

PROBLEM XXVI.

To deſcribe a Circle about a given △ is perform'd in the very ſame Manner as Prob. 23. *viz.* by dividing any two Sides of the △ in the Middle, and where thoſe Lines meet each other as at *l*, is the Centre of the Circle required.

PROBLEM XXVII.

To make one Geometrical Square equal to divers other Geometrical Squares. *(Euclid* 1. 47.*)*

Let the Lines B, C, D, and E, repreſent the Sides of ſo many Squares given.

Make any right ∠ by Prob. 5. as F, G, H, P. 37. then beginning firſt with the ſhorteſt Side E, place the ſame from H to *i*; and alſo the Line D from H to *k*; and draw *i k*, whoſe Square ſhall be equal to the Sum of both the Squares of E and D; then take the Line *i k*, and place it from H to *l*, and the Side C from H to *m*, and draw *l m*, which place from H to *n*; and alſo the Side B, from H to *p*; and draw *n p*; ſo ſhall the Square made of the laſt Line, *viz.* *n p*, (by Prob. 11.) be the Sum of all the given Squares, repreſented by their Sides B, C, D, E, which was requir'd, and thus, by proceeding after the ſame manner, may any Number of Squares be added together. Thus, alſo, may one Circle be made equal to as many Circles as ſhall be requir'd, being added by their Diameters, as Squares by their Sides; as the *Reader* may eaſily ſee.

PROBLEM XXVIII.

To reduce an irregular Figure as A, B, C, D, E, F, G, into a Square, *(Euclid* 2. 14. 6. 13. 1. 47.*)*

Draw ſtrait Lines from ∠ to ∠, dividing it into as many △'s as the Figure will admit of, which will be always leſs by 2 than the Number of Sides of the given Figure, as here 5; tho' your better way will be to order Matters ſo as to have 2 △'s to one, and the ſame Baſe, as often as you can, and as you ſee done in P. 28; where we have ſo contriv'd it, as to have but one Single △ in the whole Figure, *viz.* the △ F G E; the reſt fall two upon a Baſe, as the prick'd Lines in the Figure do plainly demonſtrate.

Having gone thus far, what follows is performed after this Manner, firſt, (by Prob. 18.) find a mean proportional Line between ½ the Baſe G B, and the two Perpendiculars falling thereon; which is done by joining the Perpendiculars in one Line, and proceeding as you are directed by Problem above. Work thus, until you have gotten a mean Proportional between each Baſe, and the two Perpendiculars falling thereon; and laſtly, between ½ the Baſe of the △ F G E, and the Perpendi-

cular thereof; so shall you obtain the right Lines L, M, N, with which proceeding in all Respects the same as in the last Problem, you will find L O, the side of a Square, equal to the Figure A, B, C, D, E, F, G, as was required: all which is evident from only a bare Inspection of the Scheme.

PROBLEM XXIX.

To describe an Oval to any Length and Breadth given.

Let the longest Diameter given be the Line F, and the shortest G. First, make A B equal to F, and C I to G, dividing A B equally at right *L*'s in *a*.

2dly, Make the Mark *c*, *b*, by dividing A *a*, and *a* B, each into two equal Parts; then with the Distance *c b* describe the two equilateral △'s *c d b*, and *c e b*; whose *L*'s are the Centres, and the Sides being continued are the Lines of Direction for the several Arches of the Oval, *viz.* A L, C F, B G, I H.

PROBLEM XXX.

To find the Centre, and two Diameters of an Oval.

Let A B C D be the Oval proposed, whose Centres, and Diameters are required.

Draw at Pleasure the two parallel Lines P E, M O, bisect them in the Points H N, and draw the Line P E besect in K, and upon K as a Centre describe a Circle at pleasure, as F L R, cutting the Oval in the Points F, L, draw the right Lines F L, bisect it in I, and through the Points I K draw the Diameter A C; through the Centre K draw the shortest Diameter B D perpendicular to the Line A C, and you have what was required.

PROBLEM XXXI.

To describe an Oval or Elipsis to any Length and Breadth by the Intersection of Lines.

Let the two Diameters given be A B, I D. First, on the Line A B describe a Circle whose Radius shall be equal to ½ the Line A B, as at C; also on the same Centre C, describe another Circle equal to the Line I, D; secondly divide the outer Circle into any Number of Parts, the more the better; as here into 24, and carry a Rular through each of those Divisions to the Centre C, you may divide the inner Circle into the like Number of Parts.

Lastly, drawing Parallels to the Diameter, from the inner Circle, and Perpendiculars from the outward, the Points of meeting will form the Elipsis or Oval required.

PROBLEM XXXII.

To draw a spiral Line about a given right Line as A C.

Divide ½ the Line A C into as many equal Parts as there are Revolutions; as here into 4, as I K G H; divide also I K into 2 equal Parts in B, upon the Point B describe the Semicircles K I, G E, H F, A D; and upon the Point I describe the Semicircles K E, G F, H D, A C; and you will have the spiral Line required.

PROBLEM XXXIII.

Upon a given right Line to describe a regular Polygon from a Pentagon to a Duodecagon; that is from a Figure of 5 to 12 Sides.

Let A B be a Line given, upon which a Pentagon, &c. is to be made. Bisect the Line A B in Q and erect the Perpendicular Q 12, from the Point A describe the Arch B H, and from B the Arch A H; and divide B H into six equal Parts, as H, 1; 1, 2; 2, 3; 3, 4; 4, 5; 5 B; this done, let a Pentagon be required. From the Point H with the Interval H 1, one of those equal Parts of B H describe the Arch I, 1, 7; and the Point I, will be the Centre of the Circle containing the given A B 5 Times; the Interval I B, being the Radius thereof; if you take the Point H for the Centre of another Circle, and H B for the Radius, this new Circle will contain the Line A B 6 Times; from the Point 7 with the Radius 7 B, a Circle drawn will contain A B 7 Times; again from the Point H, with the Interval H, 2, which makes two of the equal Parts of B H, describe the Arch 2, 8; and from the Point 8, with the Radius 8 B, you may draw a Circle, in which A B shall be the Side of an Octagon. Again from 9, with the Radius 9 B, you form a 9 sided Figure; from 10, a 10 sided Figure, and so on to 12.

PROBLEM XXXIV.

To describe a Scheme Arch, the Base and Perpendicular being given

First, draw the Line A B and bisect it at right L's by the Line *c*, *g*, *d*; and from *g* to *c* set on the Heighth of the Arch, and draw the Line *c* B; with more than ½ the Length thereof in your Compasses with one in *c* and B, describe two Arches crossing each other, a Line drawn thro' those Intersections shall cut the Line *c*, *d*, in *d*, which is the Centre of the Arch required, and the Intersection is the Centre for describing the Arch required.

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PROBLEM XXXV.

Another way to draw a Scheme Arch by the Interſections of Lines.

Firſt, draw the Baſe Line A B, and biſect it at *c*, from which erect a Perpendicular *c d* equal in Length to twice the Heighth of the Arch required; and draw the Lines A *d*, and *d* B, and divide each Line into any Number of equal Parts, as here, into ten, and drawing right Lines to every correſpondent Diviſion, as from 1 to 1; from 2 to 2, &c. the Interſections of thoſe Lines will from the Arch A *e* B as was required. See P. 35.

PROBLEM XXXVI.

To deſcribe an Arch of equal Heighth to a Semicircle but a greater Length on the Baſe.

Let A B C be a Semicircle, and *d g* the Length of the Baſe given for the Arch to raiſe equal to the Semicircle; through the Centre of the Arch A C B, at C draw the Line C *f*, at right ∠'s to A B, and to any Length at pleaſure, from the Points C and *g*, taking for your Interval any Lines longer than what you may judge the Diſtance between thoſe Points amounts to; deſcribe two Arches on either Hand; cutting each other in *a* and *i*; draw a Line ſo as to cut the Perpendicular Line of C O, and O, is the Centre for the Arch *d* C *g*, as was required.

PROBLEM XXXVII.

To deſcribe an elliptic Arch on the ſhorteſt Diameter.

Firſt, draw the Diameter A B, and on the Middle thereof at *k* erect the Perpendicular *k o*, equal to the Heighth of the Arch; divide the Perpendicular *k o*, into two equal Parts at *e*, continue out the Line A B on both Sides at pleaſure, and from the Point *k* ſet on the Length of *k o* as at *c* and *d*; through the Points *c k*, *d e*, draw the Lines *c e f* and *d e g* to a Length at pleaſure, and *d* and *c* are Centres for the Arches A *g*, and B *f*; and *e* the Centre for the Arch *g o f*, which will form the Arch required.

PROBLEM XXXVIII.

To draw a *Gothic* Arch.

Take in your Compaſſes the Length of the Line A B, and on the Points A and B, deſcribe the Arches A *c* and B *d*, and it will compleat the *Gothic* Arch, as was required.

PROBLEM XXXIX.

To deſcribe a *Gothic* Arch in another Form.

Divide the Line A B, into three equal Parts, at *c d*, take in your Compaſſes the Diſtance of two of thoſe Parts, and on the Points *c* and *d*, deſcribe the Arches A *e* and B *e*, and it is done.

PROBLEM XL.

To draw a *Gothic* Arch in another Manner or Form.

Divide the Line A B alſo into three equal Parts at *e. f*, from the Points A and B, let fall the Perpendiculars A *c* and B *d*, equal in Length to two of the Diviſions of the Line A B, draw the Lines *c b* and *d g*, from the Points *e f*, with the Length of *f* B deſcribe the Arch A *g*, and B *h*, and from the Points *c*, *d*, deſcribe the Arches *g i* and *i h*, and it is done.

PROBLEM XLI.

Another Form.

Divide the Line A B, as before, into three equal Parts, at *a* and *b*, and on the Points A, *a*, *b*, B, with the Diſtance of two Diviſions make four Arches interſecting one another at *i*, *d*; and the Diviſions *a*, *b*, draw the Lines *i f* and *d e*; and on the Points *a* and *b*, deſcribe the Arches *a*, *e*, and *b*, *f*; then on the Points *i* and *d* deſcribe the Arches *e*, *g*, and *f*, *g*; which will compleat another *Gothic* Arch as was required, then on the Points *a* and *b*, deſcribe the Arches A *e* and B *f*, and it will compleat another *Gothic* Arch, as was required.

PROBLEM XLII.

To find the ∠ of a regular Groin, or the Mitre Bracket of a Cove.

Firſt, deſcribe the Form of the Cove intended as E A B, then the Plan of the ∠, or Mitre, as the Line B C, divide the Projection, or Baſe Line B D into any Number of equal or unequal Parts, any how; and raiſing Perpendiculars to touch the Moulding of the Cove, extend alſo thoſe Lines to cut the Mitre, or ∠ B C, from thence raiſe Perpendiculars ſetting on them the Length of each correſpondent Line, from the Baſe Line to the Cove, as 1, 2, 3, &c. this done, if you trace by

by Hand or Stick, in Nails in the Points, and bend a thin Lath round them, and ſtrike by its Edge, you will find the Mould for the ∠ Bracket required.

N. B. This Method will ſerve, let the given Arch E B be what it will, Ellipſis, Ogee, *&c.* or let the ∠ be Right, Acute, or Obtuſe.

PROBLEM XLIII.

To make the different Centres for regular, or irregular Groins, ſo that their Mitre ſhall be true: Firſt, lay down the Plan of the Vault, Room, *&c.* as 1, 2, 3, 4, and draw the Diagonals, at the End from the Arch, as here the Semicircle A; and as in the laſt Problem, ſo in this, divide the Baſe Line, 1, 3, into any number of Parts, any how, and continue the Lines to touch the Arch and the Diagonal 1, 4, and from the Interſections of the Diagonal 1, 4, raiſe Perpendiculars; alſo from the ſaid Interſections raiſe Perpendiculars to the Side 3, 4, then as before in the laſt Problem ſetting off each correſpondent Length, you will form the Centres B and C required, the Lines *a b*, *c d*, *e f*, and all the correſpondent Perpendiculars being equal, then tracing or ſticking in Nails, and bending a Lath round the Points, you draw the Arch required.

CHAPTER VI.

A True Definition of *Sines*, *Tangents*, and *Secants*;

Or thoſe Lines belonging to a Circle, by which the Angles of every Right lined △ are meaſured, together with their Conſtruction, or Make; ſhewing how they are deduced from a Circle, and thence transferred to ſtraight Lines; alſo the Ratio, Reaſon, *or* Habitude, *which thoſe Lines have in Reſpect of the Diameter of a Circle, in natural Numbers.*

SECTION I.

IN the Menſuration of all Kinds of △'s we are firſt to conſider ſix Things, namely, the three Sides, and three ∠'s; of which, as you have heard, (by *Def.* 21.) every △ is compoſed; and then by having any three of them given, we may by the *Rule of Proportion*, or, (as ſome call it) the *Rule of Three*, find out a fourth, not yet diſcover'd.

But before this can be done; we muſt alſo conſider the Analogy, or Agreement of the ſeveral Parts of a △ one to another, that is, in other Words, we muſt firſt find out the way of reducing crooked Lines to ſtraight, becauſe every crooked Line in a △, as the Meaſures of the Angles in Plain, and the Sides in Spheric △'s are, muſt be firſt reduced to a right Line, which is near enough performed by the Definition of the Quantity, which right Lines, applied to a Circle, have in reſpect of the Radius, or Semidiameter of that Circle, and here it is to be *noted,* that thoſe right Lines are uſually term'd *Chords,* (or *Subtenſes*) *right* and *vers'd Sines, Co-Sines, Tangents, Co-Tangents, Secants,* and *Co-Secants,* according as they reſpect each other; all which ſhall be treated of in their Order.

Firſt then, A *Chord,* or *Subtenſe,* is a right Line drawn in Circle from one extremity of the Circumference to the other, as the Line *s*, *t*, Plate 1. Part 3. Fig. 1. or *t o*, which are the Chords of the Arches, *s*, *t*, *a*, and *t*, *c*, *o*; whence we may obſerve every Diameter is alſo a Chord Line, and the longeſt that can be drawn in any Circle whatever.

II. The right Sine of an Arch, is ½ the Chord of a double Arch, as the right Sine of *a*, *t*; or *t*, *c*, *o*, *n*, is the Line *d*, *t*, it being the half of *s*, *t*; the Chord of the Arch *s*, *a*, *t*, equal to twice *a*, *t*.

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In like manner, the right Sine of *t, c,* or *t, a. s, m,* is the right Line *t, b,* the half of the Chord, or Subtenſe *t, o*; whence it follows that the right Sine of an Arch, more or leſs than a Quadrant, and not greater than a Semicircle, is one and the ſame; for as the Arch *c, t,* is leſs than a Quadrant by the Arch *t, a*; ſo the Arch *t, m,* doth as much exceed a Quadrant, to both which Arches the Line *t, b,* is the right Sine; So that properly Speaking, whenſoever the right Sine of an Arch is called the Sine of the Complement, or Co-Sine, we are to underſtand only the Sine of the Complement of an Arch leſs than a Quadrant, as the right Sine of the Complement (*t, a,*) is the right Sine of *t, c,* that is, the Line *t, b*; or you may conceive it in other Words, thus, the Co-Sine of the Arch *c, t,* (*i, e,* the Remainder thereof into 90 Degrees) is the Arch *t, a,* the Sine whereof is *d, t*; wherefore it is properly enough ſaid to be the Co-Sine, or Sine Complement, of the Arch *t, c.*

III. The right Sine of an Arch is always perpendicular to the Diameter drawn from thence to one extremity of the given Arch, as the right Sine of *a, t,* and *t, c,* which are the two Lines *d, t,* and *t, b,* are both of them perpendicular to the Diameters *a, n,* and *m, c.*

IV. The right Sine of the Complement, or the Co-Sine of every Arch is equal to that Part or Segment of the Diameter which is intercepted, or lieth between the right Sine, and the Centre of the Circle, as *d, t,* the Co-Sine of the Arch *t, c,* is equal to *r, b*; ſo alſo the Co-Sine of *a, t,* which is the right Line *t, b,* is equal to *d, r*; and here it may be uſeful for the *Reader* to obſerve, that the Sine of 90 Degrees, and the Radius, or Semidiameter of a Circle, are all one; for the Sine of an Arch equal to a Quadrant, muſt be the Radius itſelf, ſo, the Sine of the Arch *a, c,* is the Semidiameter, *a, r.*

V. The vers'd Sine is that Part of the Diameter which lieth between the right Sine and the Circumference, as the vers'd Sine of the Arch *t, c,* is the Line *c, b,*; and the vers'd Sine of *a, t,* is *a, d.*

VI. The vers'd Sine of an Arch greater than a Quadrant is the Line *d, r, n,* the vers'd Sine of *t, c, n.*

VII. the vers'd Sine of an Arch leſs than a Quadrant is *a, d,* the vers'd Sine of *a, t*; as before.

VIII. A Tangent is a Line ſo called, for that it toucheth the Circumference, and is always drawn perpendicular to the Diameter, and that End of the Arch which cutteth the ſame; as the Tangent of the Arch *t, c,* is the right Line *b, c.*

IX. The Secant is a right Line drawn from the Centre of the Circle and the other End of the Arch, until it meets with the Tangent, as the Secant of the aforeſaid Arch *t, c,* and the ∠ at *r* is the Line *b, r.*

X. The Difference of an Arch from a Quadrant or 90 Degrees, whether it be more, or leſs, is called the Complement of the Arch; ſo *a, t,* is the Complement of the Arch *t, c*; and alſo of *t, a, m*; and *d, t,* the Sine of that Complement, *c, b,* the Tangent, and *r, l,* the Secant thereof; all which for Brevity's Sake, we call the Co-Sine, Co-Tangent, and Co-Secant of that Arch: But

XI. The difference of an Arch from a Semicircle, or 180 Degrees, ſhould be called its Supplement, and not the Complement thereof, as it uſually is; ſo the Arch *t, c,* is the Supplement of the Arch *m, a, t,* to a Semicircle.

Note, The Complements of ∠'s are the ſame, as the Complements of Arches.

XII. The Meaſure of an ∠ is the Arch of a Circle deſcribed on the angular Point, and included between two Lines containing the ∠.

Having given the *Reader* this brief and eaſy Deſcription of Sines, Tangents, &c. I ſhall next ſhew the Fabric, or Geometrical Conſtruction thereof; and then ſhall define, or expreſs in Numbers, the Relation, or Quantity that theſe Lines have in reſpect of the Radius, or Semidiameter of a Circle, which is the very Foundation, or Ground-Work of the Tables of natural Sines, Tangents, &c. So uſeful in ſundry Parts of the Mathematics, and conſequently ſo neceſſary to be underſtood by thoſe who deſire to become tolerable *Proficients* in theſe Studies. But, Firſt it will be convenient that the *Reader* ſhou'd here call to Mind the foregoing Definition of a Circle, which we ſhall briefly repeat as follows.

DEFINITIONS.

I. The Circumference is that curv'd Line which is every where equidiſtant from the Centre, or Point, whereon the Circle is deſcribed.

II. The Circumference of every Circle, be it great or ſmall, is, by *Mathematicians*, divided into 360 equal Parts, called Degrees; and each of thoſe Degrees is again divided into 60 Parts, called Minutes; ſo that a Degree is the 360th Part of a Circle; a Semi (or half) Circle is divided into 180 Degrees, and a Quadrant or fourth Part of a Circle is juſt 90 Degrees.

III. The Diameter of a Circle is a right Line drawn through the Centre of the Circle dividing it exactly into 2 equal Parts.

IV. The Semidiameter is one half of the Diameter, and is uſually termed the Radius.

SECTION II.

The Geometrical Construction of the Lines of *Sines*, *Tangents*, &c. FIG. 2.

FIRST describe the Semicircle V A T, divide it into 2 equal Parts by the Line S A, drawn perpendicular to the Diameter V T. Let each of the Quadrants be divided into 90 Degrees, and number'd from V and T, to A, by 10, 20, 30, 40, &c. to 90 Degrees.

II. Draw straight Lines from 10, in one Quadrant, to 10 in the other Quadrant, 'till you come to 90. The Line S A, so divided, shall be a Line of right Sines.

III. Upon the Point T, erect a Perpendicular to L, and from the Centre S to every 10 Degrees in the Quadrant; draw right Lines 'till they meet with the Line L T, it shall be a true Tangent Line.

IV. Those Lines which issue from the Centre to the Tangent Line T, are called Secants, and may be transfered to the right Line B A, by placing one Foot of your Compasses in the Centre, and describing an Arch from every Degree of the Tangents to the Line B A, that Line will be a Line of Secants.

V. The Line T V, which is equal to the Diameter of the Circle, or twice Radius S T, is a Line of *vers'd Sines*, and is no other than the Line of right Sines doubled, and numbered from V to T, by 10, 20, 30, 40, &c. to 180 Degrees, as is evident from the Scheme itself.

In order to give the *Reader* a clear and distinct *Idea* of those Lines when they are applied to Practice in the Business of *Trigonometry*; it will not be amiss, if we here observe, that the Radius, the Right-Sine, and the Right Sine of the Complement of any Arch, make a Plain Right-angled △, as *r*, *b*, *t*, *Fig.* 1. and the Radius, Tangents and Secants of the same Arch, make another Right-angled △, equi-angled or like to the former, as the △ *r*, *c*, *b*; and lastly, the Radius, the Tangent, Complement of the same Arch, and the Secant of the Complement of that Arch make another △, equiangled, or like to both the former, as the △ *r*, *a*, *l*.

SECTION III.

I Come now to define or express in Numbers, the Agreement that these Right Lines have, in respect of the Radius or Semidiameter of the Circle.

Suppose the Semidiameter *r*, *c*, *Fig.* 1. to be divided into 1000000 Parts, and that the Arch *t*, *c*, contains 30 Degrees, since the Chord, or Line, which Subtends 60 Degrees, is equal to the Semidiameter *r*, *c*; *t*, *b*, the Sine of that Arch, will be equal to half *r*, *c*, and consequently must contain just 500000 such Parts. Now, by a well known Proposition in *Euclid* (*viz.* the 47th *Lib.* 1.) which Teaches, that, in any Right-angled △, the Square of the Hypothenuse, is equal to the Squares of both the other Sides; we may find the rest, if we Square *r*, *t*, (1000000) *i*, *e*, if we multiply it into itself, it will produce 1000000000000 Parts; from which substracting the Square of the Right Sine *t*, *b*, *viz.* 25000000, the Remainder (999975000000) will be the Square of *r*, *b*, and *d*, *t*, the Line of the Complement; and extracting the Square Root of 999975000000, you will have the Line *r*, *b*. This done, if you say,

$$\text{As } rb : tb :: rc : cb,$$

It will give you the Tangent *c*, *b*; then adding together the Squares of *r*, *c*, and *c*, *b*, their Sum (by the same Proposition) will be the Square of *r*, *b*; of which extracting the Square Root it shall be the Length of the Secant Line *r*, *b*.

I shall conclude this Chapter, with putting the *Reader* in Mind, to observe two Things from what has been said therein.

I. We may hence Learn that the Radius, or Chord of 60 Degrees, the Sine of 90 Degrees, and the Tangent of 45 Degrees are all equal; for if you take the Length of any one of them between the Compasses, and apply it to the rest, it will exactly measure them.

II. Hence

II. Hence alſo we may perceive, the Reaſon why there are never any Chords, nor but ſeldom any vers'd Sines expreſs'd in the Tables, it being indeed needleſs; for the Chord of any Arch is eaſily found, by only doubling the Right Sine of the Arch, and the vers'd Sine of an Arch, if it be leſs than a Quadrant, is found by ſubſtracting the Co-ſine of the Arch from the Diameter; or, which is plainly the ſame Thing, that Part of the Diameter which lieth between the Right Sine and the Centre of the Circle: But if the Arch be more than a Quadrant, you muſt add the Co-ſine of the Arch to the Semidiameter, and it gives the vers'd Sine required.

CHAPTER VII.

A brief and clear Explanation of the Logarithms *of Natural Numbers, and the Table of proportional Parts, uſually ſubjoined thereunto; and alſo of the Table of* Sines, Tangents, &c. *together with their Uſe and Operations in the* Mathematics.

BY whom, or after what Manner, theſe moſt uſeful and neceſſary Tables were invented, or what Changes they have ſince undergone for the better, is not at all material for the *Reader* to be here acquainted withal, let it ſuffice in this Place to acquaint him with ſo much of their Uſe, as ſhall enable him, not only to underſtand and perform moſt of the Work of this *Treatiſe*, but alſo as will be ſufficient for almoſt any kind of Mathematical Practice whatever.

The beſt Tables of that Sort that have been publiſhed are thoſe in Mr. TAYLOR's *Theſaurium Mathematicæ*; which Tables, or thoſe of like Sort I recommend to the *Reader*, as the moſt conciſe and fit for his Purpoſe.

PROPOSITION I.

Any Number under 1000, or 100000 being given, to find the Logarithm thereof.

I. If the given Number conſiſts but of one or two Places, its Logarithm and Index are found in the Beginning, or firſt Side of the Table; as ſuppoſe 5 and 21; look in the Left-hand Column under N, and right againſt theſe two Numbers in the next Column are their Logarithms. As 5 its Log. is 0.698970. and 21 its Log. is 1.322219.

After the ſame Manner you will find the Log. of 99 to be 1.995635.

The firſt Figure towards the Left-hand, is call'd the *Characteriſtic*, or *Index*, and in thoſe Tables where it is ſet down, is always ſeparated from the reſt by a Point or Prick; but in all the late printed Tables it is left out as unneceſſary, its Uſe is to ſhew how many Places of Figures the natural Number conſiſts of; and, in whole or abſolute Numbers, is always 1 leſs in Value than the Number of Places given. Thus, if the whole Number be

1	its Index is	0
10		1
100		2
1000		3
10000		4

Which plainly ſhews the Reaſon why in all Tables, they are now left out, is becauſe they are ſo eaſily obtained.

II. If the Number whoſe Log. is ſought, conſiſts of three Places of Figures; look in the firſt Column under N, for the Number propounded, and right againſt it in the very next Column ſtands its Log. to which you muſt prefix 2 for its *Index*, being 1 leſs than the Number of Places. Thus the

Logarithm of	241	is	2.362107
	567		2.753583
	999		2.999565

III. But

III. But if the given Number confifts of 4 Places, then obferve the Directions following.

Look firft under N, for the three foremoft Places next the Left-hand, as before; then for the laft Figure, find it on the Top, and carrying your Eye downwards in the fame Column, until you are oppofite to the other three Figures under N, you fhall there find its Log. to which muft be prefix'd its *Index* 3. So the

$$\text{Logarithm of} \left\{\begin{array}{c}2427\\6888\\9999\end{array}\right\} \text{is} \left\{\begin{array}{l}3.385069\\3.838093\\3.999957\end{array}\right.$$

IV. But if your Number confifts of 5 Places, which is 1 Place more than the Table extends to, you muft in that Cafe have recourfe to the Table of proportional Parts, ufually printed at the End next after the Logarithms; by help whereof may be found the Log. required in this Manner.

Firft, Seek the Log. of the 4 foremoft Figures towards the Left-hand as before; fuppofe of this Number 2754, whofe Log. is 3.439964 the common Difference between which Log. and the next lefs found under D, is 158, which found in the Table of Differences and proportional Parts, right againft that 158, and under 3 (the Digits in Units place) ftands 47; this added to the Log. of 2754, *viz.* 3.439964 gives 440011, which with its proper *Index* is 3.440011. The Log. of 2754, required.

Here, *Note*, that the Log. of any Number is the fame, though that Number has ever fo many Cyphers added towards the Right-hand, only the *Index* alters an Unit for every Cypher, as the Log. of 27543 is 4.440011. alfo the Log.

$$\left.\begin{array}{l}\text{of } 275430\\\text{of } 2754300\\\text{of } 27543000, \&c.\end{array}\right\} \text{is} \left\{\begin{array}{l}5.\ 440011\\6.\ 440011\\7.\ 440011\end{array}\right.$$

PROPOSITION II.

To find the Logarithm of a mix'd Number, alfo a Vulgar or Decimal Fraction.

To find the Log. of a mixt Number as of 9.567.

Take the Log. of 9567, except the *Index*; and to that Log. prefix an *Index* according to the Number of Places in the integral Parts of the Number given, as afore directed.

Thus, the Log. of 9567 (which without the *Index*) is 980776; and the proper *Index* for one Place is (0) therefore the Anfwer is 0.980776; and fo for any other mixt Number. See more Examples.

$$\text{The Log. of} \left\{\begin{array}{r}369.5\\36.95\\3.695\end{array}\right\} \text{is} \left\{\begin{array}{l}2.567614\\1.567614\\0.567614\end{array}\right.$$

Here you fee the Log. are the fame, but the *Index* is changed according to the Number of Places in the integral Parts of each Number.

II. To find the Log. of a Vulgar Fraction.

Firft, find the Log. of the Numerator, and fubftract it from the Log. of the Denominator, and the Remainder is the Log. required: *i. e.* of a Decimal equivalent to the Vulgar Fraction. Example.

Let the Fraction propofed be $\frac{3456}{4567}$

The Log. of the Numerator is	= 3.538574	Subftracted
The Log. of the Denominator is	= 3.659631	From
Which Subftracted leaves	$\underline{1.}$121057	Remainder.
The Log. of .7567 = $\frac{3456}{4567}$		

Now the Reafon why the *Index* is 1, is becaufe there is no Cypher prefix'd to the Decimal, for the *Index* of every Decimal which hath a fignificant Figure next the Point is 1: But if a Cypher be fet next the Point, the *Index* is 2; and if (00) the *Index* is 3, and fo on, always increafing 1 Unit, according as the Fraction removes farther from Unity, as the following Table fhews.

In Decimals the *Index* of

·1,	.2	.342	.671 &c.	is	$\underline{1.}$
01,	.02	.03	.04 &c.	is	$\underline{2.}$
001,	.002	.003 &c.	——	is	$\underline{3.}$
0001,	.0002	&c.	—— ——	is	$\underline{4.}$
00001,	.00002	——	—— ——	is	$\underline{5.}$

Which

Which by the way is a ſufficient Direction for the *Reader* to find a Log. of a Decimal; and therefore I ſhall do no more, but give an Example or two; and ſo proceed. Only it may be needful to obſerve, firſt, that the *Index* of a Decimal is mark'd with this (-) Mark put commonly underneath, and call'd by ſome a Note of Negation, which ſerves to ſhew how many Places from the Point the firſt Significant Figure ſtands.

Examples for finding Logarithms to Decimal Fractions.

$$\text{The Log. of } \left\{ \begin{array}{r} .5 \\ .05 \\ .000579 \end{array} \right. \text{ is } = \begin{array}{l} \bar{1}.698970 \\ \bar{2}.698970 \\ \bar{4}.762678 \end{array}$$

Note, To find the Log. of a whole Number, which hath a Vulgar Fraction annex'd; change it into an improper Fraction and proceed in all reſpects as in the laſt Caſe, this is ſo plain, it needs no Example.

PROPOSITION III.

Any Log. propounded to find the whole, or mixt Number agreeing thereunto.

This is but the Converſe of the foregoing Propoſitions, and therefore needs not require many Words, Let it then ſuffice in this Place, to add only one ſhort, and general Rule, which is this.

Regard not the *Index*, but look for the Log. among thoſe which wou'd have the greateſt *Indexes*, which, having found, take the natural Number ſtanding againſt it, and point off for the Integer, according to the *Index* of the Log. propounded, as in the Examples following.

$$\text{Logarithms.} \left\{ \begin{array}{l} 3.987398 \\ 2.932575 \\ 1.883945 \\ 0.895643 \\ \bar{1}.089905 \\ \bar{2}.954242 \end{array} \right\} \begin{array}{l} \text{their Equivalent,} \\ \text{whole, or mixt} \\ \text{Numbers.} \end{array} \left\{ \begin{array}{r} 9714 \\ 856 \\ 76.55 \\ 7.894 \\ .1123 \\ .09, \text{ \&c.} \end{array} \right.$$

Note, If at any Time the Log. propoſed be not found exactly in the Tables, as in many Caſes, it will ſo happen, you muſt then take the neareſt Log. thereto for the Anſwer.

SECTION II.

Of the Uſe of the *Logarithms* in *Arithmetic*.

HENCE will appear the admirable Advantage of this Contrivance above the natural Numbers which performs the Work of Multiplication by Addition, Diviſion by Subſtraction, and the Operation of the Square, Cube, Biquadrate, &c. Roots, by an eaſy dividing by 2, 3, 4, &c.

PROPOSITION I.

To multiply one Number by another, as 91 by 36.

The Log. of 91 is = 1.959041
The Log. of 36 is = 1.556303

Which added together, is 3.515344, the natural Number of which is 3276 = to the Product of 91 × 36.

Example II. Multiply 4 by 177.

To the Log. of 177 which is = 2.247973
Add the Log. of 4 which is = 0.602060

The Sum is = 2.850033
The natural Number of which is 708 = to the Product of 177 × 4.

Example III. a mixt Number multiplied by a mixt Number as 9.336 by 12.09

The Log. of 9.336, *viz.* 0.970161
Add the Log. of 12.09 *viz.* 1.082426
The Sum is 2.052587

The natural Numbers of 112.88 = to the Product of 9.336 × 12.09.

These three Examples are sufficient to instruct the *Reader* how to multiply one Number by another, by the Logarithm, and therefore I pass on to give Directions how.

PROPOSITION II.

To divide one Number by another, as 8463 by 93.
From the Log. of 8463, *viz.* 3.927524
Substract the Log. of 93 *viz.* 1.968482
Remains 1.959042

The Log. of 91 = to the Quotient of 8463 divided by 93.

Example II. A mixt Number by a mixt Number, as 237.3 by 25.32.

From the Log. of 237.3 *viz.* 2.375297
Deduct the Log. of 25.32 *viz.* 1.403464
Remains 9.376 = 0.971833 the Quotient is 9.376.

PROPOSITION III.

To extract the Roots of the Square, Cube, Bequadrate, &c. Powers by Logarithms.

These being the most difficult Lessons in Arithmetic, are performed by Logarithms with wonderful Ease and Facility, as the following Examples do plainly make appear.

Example I. To extract the Square Root of 9801.

The Rule is, take ½ the Log. of the given Number; that half is the Log. of the Root required.
Thus, half the Log. of 9801 = 3.991270
Half whereof is = 1.995635 The Log. of 99 the Root sought.

This is prov'd by a contrary Operation, *viz.* multiplying the Log. of 99 by 2 which is the way of Squaring any Number of the Logarithms,

So the Log. of 99 = 1.995635
Which multiplied by 2

Produces the Log. of 9801. 3.991270

Example II. To extract the Cube Root of 9261.

Rule, Divide the Log of 9261 3.966658 by 3
The Quotient is the Log. of 21 the Roots 1.322219
To prove which multiply it by 3

3.966658

The Cube of 21, *i. e.* the Product of 21 multiplied into itself twice.

If any desire the Bequadrate, Sursolid, *&c.* Roots of any Number; divide its Log. by 4, 5, *&c.* This is so easy that it needs no Example; only you may note, that if the *Index* happens to be less than the Number you divide by, you must then take the two first Figures, as in common Division.

SECTION III.

The Explication of the Tables of Logarithmetical Sines, Tangents, &c. *shewing how to find the* Logarithm *of the* Sine, Tangent, *and* Secant; *or of the* Co-Sine; Co-Tangent, &c. *of any Arch or Angle of a Triangle.*

THE Method for finding the Numbers by these Tables is very easy, for, having found the Degrees on the Top, if the Arch or Angle be less than 45 Degrees, or at the Bottom if more

more than 45 Degrees; find the Minutes belonging thereto, under M, and oppoſite to thoſe Minutes, and under the Degrees on the Top, whether Sine, or Tangent, you have the Log. anſwering thereunto, and in the next Column the Co-Sine, or Co-Tangent of that Arch.

For Example,

Suppoſe it were required to find the Log. Sine, Co-Sine, Tangent, and Co-Tangent of 33 Degrees, 45 Minutes.

Turn to 33 Degrees on the Head of the Table, and in the firſt Column under M, you will find 45 Minutes oppoſite thereto, and under the Sine on the Top, is the Log-Sine of 33°. 45′ which is 9.744739. In the next Column, the Co-Sine; the next the Tangent, and the next the Co-Tangent of that Arch; which ſee hereafter.

	Log-Sine.		Co-Sine.
Deg. Min.	9.744739	Deg. Min.	9.919846
33. 45.	Log. Tang.	56. 15.	Co-Tang.
	9.824892		10.175108

But here *note*, the Co-Sine, or Co-Tangent of an Arch being ſo much as that Arch or Angle wants of 90 Degrees, the Log. of the Co-Sine, and Co-Tangent, muſt have the Number of Degrees, and Minutes under M at the Bottom of the Table prefixt thereto; as here 56°. 15′, which is all one with finding the Log. Sine, and Log. Tangent of 56°. 15′. For the Log. Sine, and Tangent of the one, is equal to the Sine-Complement, and Tangent-Complement of the other. The ſame muſt be obſerved in all the Degrees, and Minutes throughout the Table; which Anſwer in like Manner, thoſe on the Head of the Table to their Complements underneath.

Note, alſo, if the Degrees of any Sine, or Tangent exceed 90, you muſt ſubſtract thoſe Degrees and Minutes from 180°, and ſeek the Sine Tangent, *&c.* of the Remainder, which will be the Sine-Tangent, *&c.* required.

If any deſire to find the Logarithmetical Secants of Angles, which in many Tables are now left out becauſe of the little Uſe there is made of them in the preſent Practice, they may be eaſily obtained in this Manner; as ſuppoſe you want to know the Secant of the Angle 33°. 45′ ſubſtract the Co-Sine of the Arch, *viz.* 9.919846 from twice Radius, or 20.000000 the Remainder is 10.080154, which is the Secant of 33°. 45′, and after the ſame Manner may the Secant of any other Number be found.

And here, before we conclude this Chapter, it will be convenient to ſet down the following Method, to find the Complement Arithmetical of the Logarithm, (which is what will make it up 10.000000) as of 9.919846, which muſt be ſubſtracted from 10.000000 and the Remainder will be 0.080154.

Note, The Co-Arithmetical of any Tangent, is the Co-Tangent itſelf.

This Arithmetical Complement is very uſeful when in any Proportion, the Radius is not in the firſt Place; for it ſaves the Labour of Subſtraction, as you will find in ſome Operations in the next Chapter.

CHAPTER VIII.

The Solution of Right-angled plain Triangles, *Geometrically* and *Arithmetically* performed.

SECTION I.

BEFORE I proceed to lay down Rules for the Dimenſions of the Right-lined Triangles in general, I ſuppoſe it neceſſary to ſay ſomething more of the Nature and Affections of ſuch kinds of Geometrical Figures, than has been hitherto obſerv'd, in order to give the *Reader* a more clear and adequate Idea of thoſe Matters, and to render the Work of this and the following Section, plain and intelligible, I ſhall in the firſt Place repeat this uſeful *Theorem*, *viz.*

In

In all plain, or right-lined Triangles, the Sum of the three Angles taken together, are equal to two right ones, or 180°, proved thus.

Let ABC, Plate 1. Part 1. be the Triangle propofed; draw the Semicircle *d e f*, and with the fame Radius in your Compaffes, fet one Foot in A, B, and C, defcribe three Arches as in the Figure; which being taken feverally in your Compaffes, and applied from *d* to *f* in the Semicircle, will exactly meafure the fame. Confequently the ∠ B + ∠ A + ∠ C = 180°, or two right ∠'s the Meafure of the Semicircle which was to be proved.

From whence may be rationally inferred the following eafy and undeniable Conclufions.

I. That the Sum of the three ∠s of every plain △ is the fame.

II. That 2 Angles of any plain △ being known, the other is alfo found out; it being the Complement of the reft; *i. e.* what they want of 180°; or half a Circle.

III. Hence if any 2 ∠'s of one △, are equal to two ∠'s of another △, their third ∠ will alfo be equal.

IV. That no △ can have above one Right or Obtufe ∠.

V. If in any △, one ∠ be right, the other two muft be acute, and taken together, will be equal to one right ∟.

VI. From a Point given, only one Perpendicular can be drawn to the fame Line.

VII. A Perpendicular, is the fhorteft of all Lines that can be drawn from the fame Point to the fame Line.

VIII. In a Right-angled △, the Right ∠ is the greateft, and the Side oppofite thereto, the greateft, or longeft Side.

IX. That every ∠ of an equilateral △ contains juft 60°, or a third Part of two Right ∟'s *viz.* 180°.

X. All ∠'s whatever, concurring or meeting together in one Point upon a Right Line, being taken together, are equal to two Right ∟'s.

XI. In every △ two Sides taken together, are longer than the third.

XII. The three Sides comprehending the △, fome call Legs, others Sides: But when two Sides of a △ are confider'd, the third may be called the Bafe, though that which lies parallel to the Horizon, or next to us, is moft properly fo termed, as the Line *b*.

XIII. Again, others diftinguifh the three Sides of a Right-angled △ thus: They call the under Side *b*, the *Bafe*; the Perpendicular *c*, they call the *Cathethus*, and the longeft Side *d*; or that which includes the Right ∟, they call the *Hypothenufe*.

But if the Side *d*, be undermoft, the Lines *c*, and *b*, are then more properly call'd Legs for the Diftinction's fake.

XIV. The ∠'s of all Plain △'s are meafured by a Scale of Chords; but the Sides by any Scales of equal Parts, as Feet, Inches, &c.

XV. Every Side of a △ is called the fubtending Side of that ∠ which is oppofite thereto; as in the △ *a*, *b*, *c*, the Side *a*, *c*, fubtends the ∠ at *b*; and *a*, *b*, Subtends the ∠ at *c*. Whence, *note*, that the greateft Side always Subtends the greateft ∠, the leaft Side, the leaft ∠; and equal Sides Subtend equal ∠'s.

Note, alfo, the two Sides of any △ are call'd the containing Sides of the ∠ contained, or comprehended between them; as the Sides *(a) (b)* and *(a) (c)* are the containing Sides of the ∠ *a*.

Thefe things being premis'd, I come next to fhew, how by having any three of the fix Parts pertaining to a plain △ (the three ∠'s only excepted) the reft may be eafily obtained: But firft let me add farther (for the fake of the young *Learner*) the following Obfervations.

I. In refolving of plain Triangles, the ∠'s only being given, the Reafon, or Proportion of the Sides may be found; but not the Sides themfelves, 'tis therefore neceffary that one of the Sides be underftood.

II. In a Right-angled △, two Terms, (befides the right ∠) given are fufficient to give a third; fo that one of the Terms be a Side. But,

III. In Oblique △'s three Things, and one of them a Side, muft be given to find a fourth.

Of the Solution of the feven CASES of *Right angled plain Triangles*, chiefly founded on the following AXIOMS.

AXIOM I.

IN every plain right angled △, if one of its Sides be made Radius, the other will be either Sines, Tangents, or Secants.

That is, As in (1) Triangle.

First,

First, if you make B C Radius, then will the Sides A C and B C, including the right L, be the Sines of the opposite ∠'s B and C.

II. If you make the Side A B Radius, then the other Side A C, will be the Tangent of the ∠ B, and the Hypothenuse B C, is the Secant of the ∠ B.

III. If you make the shortest Side A C Radius, then will the longer Side A B, including the right ∠, be the Tangent of the greater Acute L C; and the Hypothenuse C B, is the Secant thereof.

Now from the foregoing *Axiom*, followeth this *Consectary* or *Conclusion*, *viz.*

That in all Right-angled plain △'s the L's being given, the Reasons or Proportions of the Sides are also given three several ways; and by Consequence.

If one Side beside the three ∠'s, be given the rest of the Sides are obtained by a three-fold Proportion, according to which Side you make Radius.

And what Proportion soever the Side made Radius, hath to Radius, the very same have the other Sides to the Sines, Tangents, *&c.* by them represented; and the Contrary.

Note, 1. That to find a Side, any Side may be made Radius, saying thus:

As the Word on the given Side, is to the given Side,

So is the Word on the Side required, to the Side required.

Note, 2. To find an ∠, one of the given Sides must be made Radius, then say

As one of the Sides given is to the Word on it,

So is the other given Side, to the Word thereon.

Always observing to begin with the Side made Radius.

This may be sufficient to instruct the diligent *Learner*, though but of an ordinary Capacity, in ordering the Terms of any Proportion for the Resolution of a Right-angled △. But that I, by this first *Axiom*, may make all plain and easy, even to the meanest Understanding; especially in a Matter which is of the utmost Consequence to be carefully heeded by a young *Practitioner*. I shall add the following Directions, for managing the Proportions of all the Cases of Right-angled plain △'s hereafter delivered.

I. If in resolving any of those Questions, the Hypothenuse be made Radius, and a Side demanded; an ∠ must be the first Term in the Proportion, and it must be an ∠ that is opposite to the Side given, the Side given must be the second Term, and the ∠ that is opposite to the Side demanded, the third Term.

II. But if an L be demanded, a Side must be the first Term, and it must be that Side that is opposite to the ∠ given; the ∠ given must be the second Term, and the Side opposite to the ∠ required, the third Term.

III. If the Base be made Radius, and the ∠ at the Base demanded, then, besides the Base, there must be given, either the Hypothenuse or Perpendicular; and then will the made Radius, be the first Term in the Proportion; the true Radius the second; and the made Tangent, if the Perpendicular be given; or the made Secant, if the Hypothenuse be given, will be the third Term.

IV. But if the made Radius be demanded, then the true Tangent, or true Secant of the ∠ given, will be made the first Term; the made Tangent or Secant the second Term, and the true Radius the third Term.

V. If the Perpendicular be made Radius, and the ∠ at the Perpendicular be demanded, then must either the Hypothenuse or Base be given, and the made Radius must then be the first Term; the true Radius the second; and the made Tangent, or Secant, the third Term.

VI. But if the made Radius be demanded, the L at the Perpendicular, with either the Base or Hypothenuse, will be given, and then the true Tangent or Secant must be the first Term; the made Tangent, or Secant, the second; and the true Radius the third Term. See HOLWELL's *Trigonometry*, Page 12.

CASE I.

The two Accute ∠'s (A) and (C), and the Hypothenuse (A C) being given, to find the Base (A B).

Admit the △ given be A, B, C, whose ∠ at B, is a right one, or 90°, the ∠ at C is 57°, 35'; and the Hypothenuse, A C is 871.8 Parts, then will the ∠ at A, be 32°, 25'; it being the Complement of the L C to 90°, and this △ I shall make use of in Solving the 7 Cases of Right-angled plain △'s, which I intend to perform both Geometrically, and Arithmetically; and therefore to solve this first Case.

1. By making the Hypothenuse (A C) Radius. Then will the Analogy or Proportion be (by *Axiom* 1. and *Note* 1.) thus:

As Radius or 90°.	10.000000
Is to the Hypothenuse A C, 871.8 Parts,	2.940417
So is the Sine of the ∠ C, 57°. 35'.	9.926431
To the Base A B, 736 Parts.	2.866848

The Geometrical Performance hereof is as follows.

First, with the Chord of 60° in your Compasses, set one Foot in A and with the other describe the Arch C D at pleasure; then with 32°, 25' in your Compasses (taken from the same Line of Chords) with one Foot in D, with the other make the Mark C, which forms an ∠ of 32°, 25'; then from any Line of equal Parts, take 871.8 in your Compasses, and set it from A to C, lastly, let fall the Perpendicular C B, and it is done; and if you take the Line A B in your Compasses, and apply it to the same Line of equal Parts, you will find it to be 736 Parts as above.

Observe this for a general Rule.

If four Numbers are Proportional, to add the Log. of the second and third Terms together, and from their Sum substract the Log. of the first Term, or Number; the Remainder is the Log. of the fourth Term, or Number sought, as in the Operation above.

Note, that *s* stands for Sine, *co.-s.* for Co-Sine (or Sine Complement). *t* for Tangent; *co.-t.* for Co-Tangent, (or Tangent Complement). *se.* for Secant; *co-ar.* for Complement Arithmetical; and °, ', ", set over Figures, denote Degrees, Minutes, and Seconds: And *note,* Things given are mark'd with a Dash thus (') and Things required thus (S).

II. By making the Base (A B) Radius. The Proportion will be

As *se.* of the Angle A 32°, 25'.	10.073569
To the Hypothenuse A C, 871.8.	2.940417
So is the Radius, or 90°.	10.000000
To the Base A B, 736.	2.866848

By making the Perpendicular Radius, the Proportion will be

As *se.* ∠ C; 57°, 35', *co-ar.*	0.729223
To the Hypothenuse A C, 871.8.	2.940417
So *t,* ∠ C; 57°, 35'.	10.197207
To the Base A B, 736.	2.866847

Note, If your first Number be either a Tangent, or Secant, you may then take the Co-Tangent, or Co-Sine: for the Tangent Complement of an Arch, is the Co-Arithmetick thereof; and the Co-Sine is exactly the Co-Arithmetical of the Secant of that Arch. So the Co-Arithmetical of the Secant of the ∠ C in the last Operation is 0.729223. In any such Proportion you add all the three Terms together, the Sum (abating Radius) will be the Answer. See the last Example.

CASE II.

The two Acute ∠'s (A and C) and the Base (A B) being given to find the Perpendicular (C B)

I. By making the Hypothenuse Radius. The Proportion (by *Axiom* 1. *Note* 1.) is

As *s.* ∠ C 57°, 35' Co-Arithmetical.	0.073569
To the Log. of the Base A B, 736.	2.866848
So *s.* ∠ A 32°, 25'.	9.729223
To the Log. of the Perpendicular B C, 467.4.	2.669640

II. By making the Base Radius. The Proportion is

As Radius 45°.	10.000000
To the Base A B, 736.	2.866848
So *t.* ∠ A 32°, 25'.	9.802792
To the Perpendicular C B, 467.4	2.669640

III. By

III. By making the Perpendicular Radius. The Proportion is

(*Note*, When the Tangent is in the Proportion, the Radius then is the Tangent of 45°, as in the Operation above, which must be carefully heeded when you work by the Scale.)

As *t.* ∠ C, 57°, 35′.	10.197207
To Radius 45°.	10.000000
So the Base AB, 736,	2.866848
To the Perpendicular BC 467.4.	2.669641

GEOMETRICALLY,

First, take 736 from any Scale of equal Parts, equal to which draw the Line AB; and from B erect a Perpendicular, then make the ∠ A equal to 32°, 25′, as above directed, and draw the Line AC, till it meets with the Perpendicular BC; then if you measure BC upon the same Scale of equal Parts; it will give 467.4 the Length thereof as before.

CASE III.

The two ∠'s (A and C) with the Base (AB) given, to find the Hypothenuse (AC)

I. By making the Hypothenuse Radius.

The Proportion (by *Axiom* 1. and *Note* 1.) is

As *s*, ∠ C, 57°. 35′,	9.926431
To the Base AB, 736,	2.866848
So is the Radius 90°.	10.000000
To the Hypothenuse AC 871.8.	2.940417

II. By making the Base Radius, the Proportion is

As Radius 90°,	10.000000
To the Base AB, 736,	2.866848
So *se.* ∠ A, 32°, 25′,	10.073569
To the Hypothenuse AC, 871.8.	2.940417

III. By making the Perpendicular Radius, the Proportion is

As *t* ∠ C 57°, 35′ Ar-Co.	0.802792
To the Base AB, 736,	2.866848
So *se.* ∠ C, 57°. 35′.	10.270777
To the Hypothenuse AC, 871.8.	2.940417

GEOMETRICALLY,

This Case is performed in the very same Manner as the last.

CASE IV.

The Base (AB) and the Perpendicular (BC) being given, to find either of the ∠'s (A or C.)

I. The Proportion (by *Axiom* 1. *Note* 2.) making the Base AB Radius, is

As the Base AB, 736,	2.866848
To Radius 45°,	10.000000
So the Perpendicular BC, 467.4.	2.669640
To *t.* ∠ A 32°, 25′,	9.802792

Which substracted from 90°. gives the ∠ C 57°, 35′.

II. The Proportion, making the Perpendicular Radius, to find the ∠ C, is

As the Perpendicular BC, 467.4.	2.669640
To Radius 45°.	10.000000
So the Base AB, 736.	2.866848
To *t.* ∠ C 57°, 35′.	10.197208

Which

Which being taken from 90°, leaves 32°, 25′ the ∠ A, so that either of the Proportions is sufficient to find both the Angles.

GEOMETRICALLY,

1. Make A B = 736, and upon B erect the Perpendicular B C.
2. Make B C = 467.4, and draw the Hypothenuse A C.
3. With 60° of a Line of Chords, draw the Arch B E, then if you measure B E with the same Line of Chords, you will find it = 32°, 25′, the ∠ A; the Complement whereof to 90° is 57°, 35′ = ∠ C.

I suppose the *Reader*, by this Time, is so well acquainted with the several Signs or Characters explained and used in this *Book*, and the Geometrical Protraction of this kind of △'s as to need but few Words to apprehend it.

CASE V.

The Base (A B) and Hypothenuse (A C) given to find the Angles (A and C)

I. The Proportion by (*Axiom* 1. *Note* 2.) making the Hypothenuse Radius to find the ∠ C is,

As the Hypothenuse (A C) 871.8.	2.940417
To Radius 90°,	10.000000
So the Base A B, 736,	2.866848
To *s.* ∠ C, 57°, 35′.	9.926431

The Complement whereof to 90°, is the ∠ A: 32°, 25′.

II. The Proportion, making the Base Radius, to find the ∠ A.

As the Base A B, 736,	2.866848
To Radius 90°.	10.000000
So the Hypothenuse A C, 871.8.	2.940417
To *se.* ∠ A 32°, 25′.	10.073569

Which taken from 90°, gives the ∠ C, as before.

GEOMETRICALLY,

1. Make A B = 736, and erect the Perpendicular B C.
2. Take 871.8 in your Campasses, and placing one Foot thereof in A, with the other cross the Line B C in C, and draw the Line A C.
3. With 60° of the Line of Chords, describe the Arch B D which being measur'd upon the Line of Chords will be 32°, 25′ the ∠ required.

CASE VI.

The Base (A B) and Perpendicular (B C) given, to find the Hypothenuse (A C).

The resolving of this and the following Case will require two Operations, one to find an ∠, and the other by the help of that ∠, to find the Side required.

OPERATION I.

The Proportion by (*Axiom* 1. *Note* 2.) making the Perpendicular Radius, to find the ∠ C, is

As the Perpendicular B C 467.4.	2.669640
To Radius 45°.	10.000000
So the Base A B, 736,	2.866848
To *t* ∠ C, 57°, 35′.	10.197208

OPERATION II.

The Proportion by (*Axiom* 1. *Note* 1.) making the Hypothenuse Radius, to find A C.

As *s.* ∠ C, 57°, 35′.	9.926431
To the Base A B, 736.	2.866848
So is Radius 90°,	10.000000
To the Hypothenuse, 871.8.	2.940417

GEOMETRICALLY

GEOMETRICALLY,

The Geometrical Construction hereof, is the same with Case IV. where, besides finding the Quantity of the ∠'s A and C, the Hypothenuse, you will find it to contain 871.8, as above.

I wou'd for the Benefit of the *Reader* have delivered the Performance of those *Cases* instrumentally, but my design'd Brevity cou'd not afford me room in this *Volume*.

CASE VII.

The Base (A B) and the Hypothenuse (A C) given, to find the Perpendicular.

The two Operations making the Hypothenuse Radius, are as follows,

As Log. Hypothenuse A C, 871.8	2.940417
To Radius 90°,	10.000000
So Log. Base A B, 736,	2.866848
To *s.* ∠ C, 57°, 35',	9.926431

Whose Complement to 90°, is 32°. 25', ∠ A. Then say,

As Radius 90°.	10.000000
To Log. Hypothenuse 871.8	2.940417
So *s.* ∠ A, 32°, 25',	9.729223
To Log. Perpendicular, 467.4	2.669640

GEOMETRICALLY,

Make A B = 736 and draw the Perpendicular B C, then take 871.8 in your Compasses; and placing one Foot thereof in A, with the other cross the Perpendicular in C, so shall B C, measur'd upon the Scale, be 467.4, the Length of the Perpendicular required.

SECTION II.

Of *Oblique Right-lined* TRIANGLES.

HAVING in the former *Section*, sufficiently, fully, and clearly, explained all the Cases of plain Right-angled Triangles; now I shall, to compleat the whole Doctrine of the Dimensions of plain Triangles, proceed with the same Plainness to treat of the five Cases of Oblique-angled Triangles remaining. But before I lay down particular Rules for the Resolution thereof; I shall here exhibit the several *Axioms*, upon which the whole Work depends, leaving their Demonstrations (which I conceive not so easy for a young Beginner to understand) to be learned from such *Authors*, as have made it their Business to handle these Matters, for the Sake of the ingenious, and who have Wrote more Learnedly thereupon.

AXIOM I.

In every plain △ (as well Right as Oblique-angled) the Sines of the ∠'s are proportional to their opposite Sides, and the Sides to their opposite ∠'s: that is,

As the Sine of any ∠ is to its opposite Side, so is the Sine of any other ∠ to its opposite Side, and contrarily.

As any Side is to its opposite ∠, so is any other Side to its opposite ∠. So that if the Side of a △ be required. Put the Sine of the opposite ∠ in the first Place, But if an ∠ be required, put the Log. of its opposite Side in the first Place.

Take special Notice of the foregoing *Axiom*, (which some call the Rule of Opposites) for its extraordinary Usefulness in most Cases of plain Trigonometry; and if rightly understood, will, with a very few Directions beside, render the whole Business thereof easy, and intelligible.

This *Axiom* duly consider'd will afford the following Considerations.

1. That the ∠'s of any △ being given, the Reason of the Sides is also given, and by Consequence, if one Side besides the ∠'s be given, the other Sides are also given.

2. That

2. That any two Sides with an ∠ oppofite to one of them, being given, the oppofite ∠ to the other Side is alfo given.

AXIOM II.

In all plain △'s, as the Sum of the two Sides including the ∠ given, is to their Difference, fo is the Tangent of the ½ Sum of the oppofite ∠'s, to the Tangent of ½ the Difference of the faid ∠'s.

This *Axiom* is ufeful when two Sides and an ∠ between them are given, to find the third Side, and either of the other ∠'s.

Note, the Sum of the oppofite ∠'s will be known, being what the given ∠ wants of 180°, and their Difference is found by this *Axiom*; and by adding the half Sum and half Difference together, you will have the greater ∠ fought, or by fubftracting the half Difference from the half Sum, the Remainder is the Quantity of the leffer ∠ required.

AXIOM III.

In all plain △'s; as the greateft Side is in Proportion, to the Sum of the two other Sides; fo is the Difference of thofe Sides, to a Part, or Segment of the Greater; which being taken from the greateft Side, a Perpendicular let fall from the ∠ oppofite to the greater Side, fhall divide the Remainder in the Middle, and the Oblique △ into two Right-angled △'s.

To illuftrate this *Axiom*, more fully and plainly; let us fuppofe the △ A, B, C, to be given, whofe greater Side is A B, and leaft Side B C.

Upon C as a Centre at the Diftance of B C, defcribe the Semicircle D B F E, and let the Line A C, be continued to D; fo is A D the Sum of the Sides, A C, and C B; for C B, and C D are equal, fo alfo are C B, and C E, and therefore A E muft be the Difference of thofe Sides. See Plate 1. Part II. Fig. 1. of Trigonometry,

Hence we may include, that as the greateft Side A B is in Proportion to A D; the Sum of the other two Sides; fo is A E the Difference to A F, a Segment or Proportion of the greater Side A B, which taken therefrom, the Remainder is F B, in the Middle whereof falleth the Perpendicular, C G; for G B and F G are equal; and thus have we alfo the Oblique △ A, C, B, divided into two Right-angled ones A G C, and C G B, and fo the ∠'s may be found by *Axiom* 1.

By thefe three *Axioms*, all the Conclufions of Right-lined △'s may be refolv'd; and tho' they are all chiefly intended for the Oblique-angled, yet are they likewife true in all plain △'s whatfoever.

This laft *Axiom* is of Ufe, when the three Sides of a △ are given to find an ∠.

CASE I.

The ∠'s *viz.* (A and B) and the Side (A C) given, to find the other Sides, *viz.* (A B and B C)

In the △ A, B, C, let the ∠ at A, be 50°, and the ∠ at B, 37°, and the Side A C, be 30 Parts. (by *Axiom* 1.)

The Proportion for finding B, C, is thus:

As *s.* ∠ B, 37° 00' *Ar-co.*	0.220537
To the Log. A C, 30.	1.477121
So is *s.* ∠ A, 50°. 00'.	9.884254
To Log. B C, 38°. 19'.	1.581912

Remember always (as it is faid before) that in every Right-lined △ the three ∠'s thereof are equal to two Right ∠'s, or 180°. So that any two of them being known, the third ∠ is alfo found, being the Complement of the other two to 180°; as here the ∠'s A and B being known, I fay the ∠ C is alfo known to be 93°. for the Sum of the two ∠'s A and B *(viz.)* 87 being fubftracted from 180°, there remains 93, the Quantity of the ∠ C; and therefore having found all the ∠'s.

II. The Proportion to find the Side A B (by the *Axiom*) is

As *s.* ∠ B, 37°, 00'. *Ar-co.*	0.220537
To the Side A C, 30.	1.477121
So is *s.* ∠ C, 87.	9.999404
To the Side A B, 49.78.	1.697062

In the laft I fubftract from 180° the ∠ C being above 90, and work by the Remainder, *viz.* 87°, the like muft be obferv'd in all fuch Cafes.

And here *note*. In finding an ∠ by the Proportion, it will fome Time be doubtful whether the ∠ fought, be Acute or Obtufe, the Log. being the fame to both. Nor can this Doubt be

rofolv'd

resolv'd better, than by a true Delineation of the Δ, or else finding the third ∠, (as you have been before directed) except you had rather Work by this.

General Rule,

See if the Square of the Side subtending the doubtful ∠, exceed, the Sum of the Squares of the other two Sides; then it is Obtuse, if they are equal, 'tis right; but if it be less, then the ∠ required is Acute.

The *Geometrical* Performance is as followeth.

1. Make A C 30 Parts, and make the ∠ A, 50°, 00', and draw the Line A B, at pleasure.
2. Make the ∠ C 93°, 00' and draw the Line C B until it meets with the Line A B, in the Point B, so shall B be the other ∠ of the Δ, and if A B and B C be measured upon your Scale, they will be found to contain 38.19, and 49.78 Parts, as before.

CASE II.

Two Sides, *viz.* (A C and C B) with an ∠ (A) opposite to one of them being given, to find the ∠ B opposite to the other Side.

I. The Proportion (by *Axiom* 1.) to find the ∠ B is,

As the Side C B 38.19. *Ar-Co.*	8.418088
To s. ∠ A, 50°, 00'.	9.884154
So is the Side A C, 30.	1.477121
To s. ∠ B 37°, 00.	9.779463

But if the Sides A B and C B and ∠ A opposite to C B had been given, and ∠ C required.

Then the Proportion [by the said *Axiom*] had been thus:

As the Side C B, 39.19 *Ar-Co.*	8.418088
To s. ∠ A, 50°, 00'.	9.884254
So the Side A B, 49.78.	1.697062
To s. ∠ C, 93.00.	9.999404

Here now, you may more immediately see the absolute Necessity there was for adding the *Note* upon the last Case foregoing, concerning the Doubtfulness sometimes of the requir'd ∠: for looking in the Tables of Log. Sines, &c. for the Log. of 9.999404, I find against it 87°, 00', whereas the ∠ required is really 93°. But 9.999404 being the Log. Sine to both these ∠'s, it may be question'd by young Beginners, which of them it belongs to. Now, in Case of any such Doubt, either of the aforemention'd Ways, will determine whether it be the Sine of an Accute, or an Obtuse ∠: That is, whether the ∠ sought be more or less than 90°. So 9.999404 is discover'd to be the Sine of an Obtuse ∠; the Measure whereof is 93°, 00'.

And here observe farther, for your help in this Matter, that if the ∠ given be Obtuse, the ∠ required is Acute, and if it be Acute, and opposed to the greater Side, the requir'd ∠ is also Acute. But when the given ∠ is Acute, and opposed to the lesser Side, then the ∠ sought may be term'd a Doubtful ∠, and must be determin'd by one of the forementioned Ways.

The *Geometrical* Protraction thereof, is as followeth,

Make A C equal to 30 Parts; then make the ∠ A equal to 50°, 00', and draw the Line A B; again take 38.19 from your Scale of equal Parts, and setting one Foot in C, with the other cross the Line A B, in the Point B, and draw C B; so you have compleated the Δ required.

CASE III.

Two Sides, *viz.* [A B and A C] with an ∠ included between them, *viz.* [A] being given, to find the other ∠'s.

The Operation [by *Axiom* 2.] is as follows,

First, find the Sum and Difference of the Sides A B and A C, also the half Sum of the two opposite ∠'s thus:

Side	A B is 49.78		Parts.
	A C is 30.00		
Sum		79.78	
Differ.		19.78	

Then to find the Sum of the ∠'s C and B substract the ∠ A from 180° the Remainder is the Sum of the other two.

50°. from

50°. from 180, there remains 130°, the Sum of the ∠'s C and B, half of which is 65. Having obtained thus much, the Proportion to find the ∠'s C and B, is

As the Sum of the Sides 79.78 *ar-co.*	7.088106
To the Differ. of said Sides, 19.78.	0.296226
So *t* ½ Sum of the opposite ∠'s, 65°. 00'.	10.331327
To *t*, ½ Differ. of the opposite ∠'s 28°. 00'.	9.725659

Which added to the ½ Sum of the opposite ∠'s C and B, *viz.* 65, will give the greater ∠ C. 93.00; and being substracted, leaves the less ∠ 37°. 00'.

I presume it must be needless to give any Scheme or Directions for the *Geometrical* Performance of this and the two following Cases, to any who have but indifferently considered the last; for he that knows how to perform that, cannot be ignorant of those, and therefore I shall not wast Time and Room to no purpose, by saying any thing farther about it.

CASE IV.

Two Sides, *viz.* (A B and C B) with an ∠ included between them, *viz.* (B) given, to find the third Side.

The Operation by the last forementioned *Axiom*, is

1. Find the Sum and Difference of the Sides, and also the ½ Sum of the two opposite ∠'s, as before in the last Case, thus

Side A B	49.78		180°
Side C B	38.19		37
Sum	87.97	½)	143
Differ.	11.59		71°, 30' = ½ Sum of the ∠'s A and C.

As the Sum of the Sides A B and C B 87.97. *ar.-co.*	7.055665
To their Difference 11. 5.	2.064003
So is *t.* of ½ the Sum of the opposite ∠'s A C, 71°. 30.'	10.475480
To *t.* of ½ the Difference of these ∠'s 21°, 30'.	9.595228

Which added to 71°. 30', gives the greater ∠ C 93°, 00.

Or, being substracted therefrom, leaves 50°. 00' for the upper ∠ A.

And thus having found all the ∠'s, you may find the Side A C by the first *Axiom*, saying,

As *s.* ∠ A 50°, 00'. Ar-Co.	0.115746
To the Side C B, 38. 19.	1.588012
So *s.* ∠ B, 37°. 00.	9.779463
To the Side A C required, 30.	1.477121

CASE V.

The three Sides of any Oblique-angled Triangle given, to find the Angles.

The Manner of Operating in resolving this Case (by the third *Axiom.*)

1. To find the Sum and Difference of the two shortest Sides, *viz.* (A C and C B) which in the Δ we have all along made Use of in resolving the several Cases, of Oblique plain Δ's is as followeth, and is performed by three several Operations, *viz.*

Side A C	38.19	
Side C B	30.00	
Sum	68.19	Whose Base A B is 49.78. Then say,
Differ.	8.19	

As the greatest Side A B 49.78, *ar-co.*	8.302938
To the Sum of the other two Sides 68.19	2.833721
So is the Difference 8.19	1.913284
To the Difference of the Segments of the Base A B, 11. 22.	3.049943

Which

Which Difference A D, being added to the greater Side A B, gives a Number, ½ whereof is the greater Segment A E; and being fubftracted therefrom, leaves a Number, the ½ of which, is the leffer Segment of the Bafe A B; to wit, E B.

The greater Side	A B,	49.78
Difference of the Segments	A D,	11.22
		38.56
The half of which, is the leffer Segment	F B,	19.28

From C let fall the Perpendicular C E which reduces the △ given, into two Right-angled △'s, *viz.* A E C and C E B, whofe Bafes, and Hypothenufe of each △ being given, as appears from the Figure, we may proceed on, and find all their ∠'s (by *Axiom* 1. Cafe V.) of Right-angled △'s thus:

I. In the △ A E C, the Proportion is

As the Hypothenufe A C, 38.19
To Radius 90°.
So is the Bafe A E, 30.50.
To *s.* ∠ C, 53°. 00′.
Whofe Complement is ∠ A 37°. 00′.

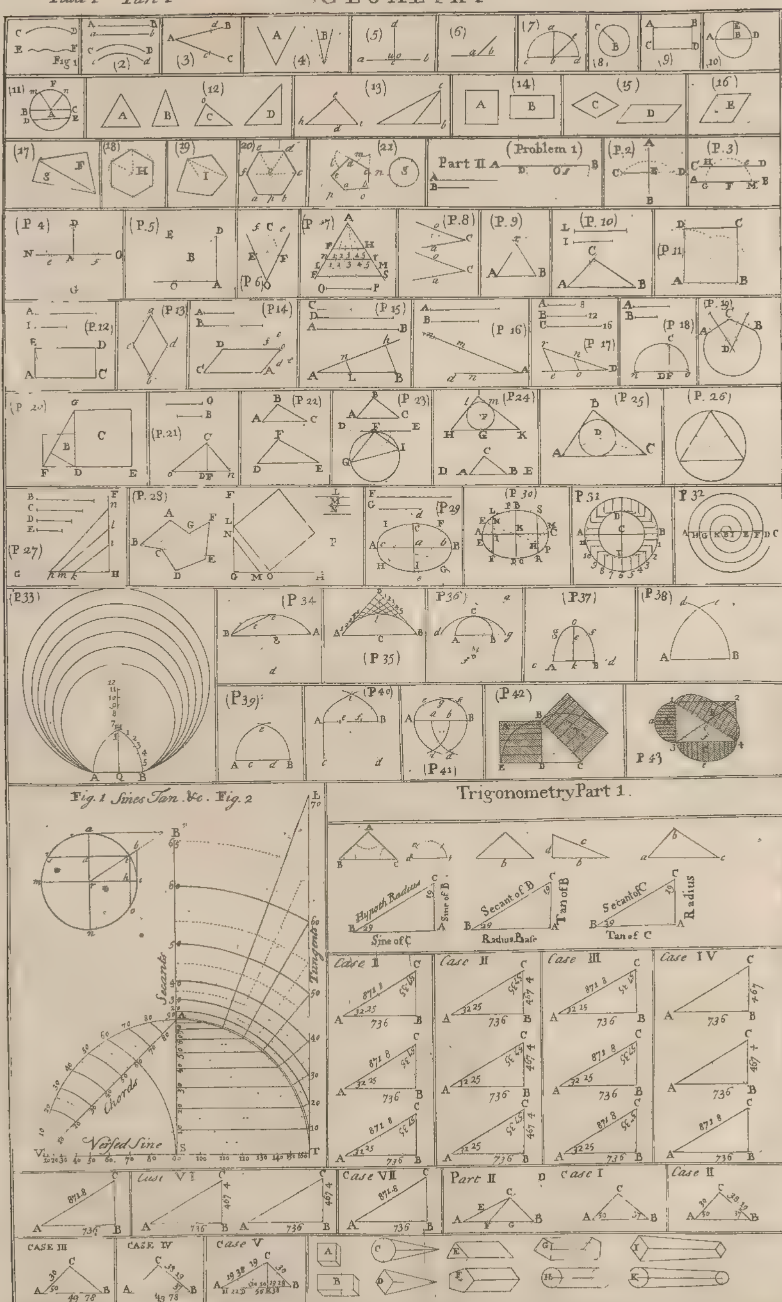
II. In the △ C E B, the Proportion is

As the Hypothenufe C B, 30.
To Radius 90°.
So is the Bafe E B, 19.28.
To *s.* ∠ C, 40°. 00′.
Whofe Complement is the ∠ B 50°. 00′.

Now, if you add the ½ ∠'s laft found, *viz.* 53°, and 40°, together; it will produce the whole Quantity of the Obtufe ∠ C, 93°, 00′.

Plate I Part I

GEOMETRY



A

GENERAL TREATISE

OF

ARCHITECTURE.

BOOK II.

PART I.

A small *Compendium* of the *Ground Rules* of *Architecture*, collected from the best AUTHORS, and EXAMPLES.

THERE are several Rules, or Precepts laid down by *Architects* concerning the Art of well Building; some respecting the Situation, or total Posture of the Building; as that it be in good and healthy Air; not subject to Fogs, or Mineral Exhalations, or malign Influence; that it be not far from an Arm of the Sea; that it hath a pleasant Prospect; and the first Salutation of the Spring; but those are rather Wishes, than Precepts.

All the Parts of every Fabrick may be, according to BAPTISTA ALBERTI, compriz'd under five Heads, which are,

The Foundation, the Walls, the Apertions, or Overtures, the Compartition, and the Cover.

First, concerning the Foundation, which requireth the exactest Care, for if that happeneth to Dance, it will mar all the Mirth in the House; therefore, that we may found our Foundation firmly; we must first examine the Bed of Earth upon which we are to Build, and then the Under-fillings, not to Rest upon any apparent Solidity, unless the whole Mould through which we cut, has likewise been Solid; but how deep we shou'd go in this Search cannot certainly be determined, depending more upon Discretion, than Regularity, according to the Weight of the Work; yet ANDREA PALLADIO allows the sixth Part of the Height of the whole Fabrick, unless the Cellars be under Ground, in which Case, he wou'd have us Found somewhat lower.

Some *Italians* prescribe, that when they have chosen the Plot, and laid out the Limits of the Work, they shou'd first of all, dig Wells, and Cisterns, and other Conduits, and Conveyances for the Suillage of the House, whence may arise a double Benefit; for both the Nature of the Soil wou'd be safely

ſafely ſearch'd; and moreover, thoſe open Vents will ſerve to diſcharge ſuch Vapours, as having otherwiſe no Iſſue, might peradventure ſhake the Building, this is enough for the natural Groundings.

Now followeth the Subſtruction, or Ground Work of the whole Edifice, which muſt ſuſtain the Walls, about which are theſe Rules. Firſt, that the Bottom be preciſely Level, where the *Italians* commonly lay a Platform, that the loweſt Ledge or Row be meerly of Stone, and the Broader the better, cloſely laid without Mortar, which is a general Caution to all Parts of a Building, that are contiguous to Board, or Timber, becauſe Lime and Wood are inſociable, and if any where, unfit Confiners, then eſpecially in the Foundation. Secondly, that the Breadth of the Subſtruction be at the leaſt, double to the inſiſtant Wall, and more or leſs, as the Weight of the Fabrick ſhall require; for Diſcretion in this may be freer than Art.

Now the Foundation being ſearch'd, and the Subſtruction made, we muſt next ſpeak of the Walls.

Walls are either entire, continual, or intermitted; and the Intermiſſions be either Columns, or Pilaſters: Concerning the entire Walls, there are theſe Conſiderations, *viz.* that the Walls be moſt exactly perpendicular, to the Ground-work; for if the right Angle thereof is the true Cauſe of the Stability, both in natural and artificial Poſitions; a Man likewiſe ſtandeth firmeſt, when ſtanding moſt upright. That the maſſieſt and heavieſt Materials be the loweſt, as fitter to bear, than to be borne. That the Work as it riſeth, diminiſh in Thickneſs proportionally, for Eaſe both of Weight and Expence. That certain Ledges of more Strength than the reſt be interlaid, like Bows to ſuſtain the Fabrick from total Ruin, if the under Part ſhould decay; laſtly, that the Angles be firmly bound, which are the Nerves of the whole Edifice, and therefore are commonly fortified by the *Italians*, even in their Brick Buildings, on each Side of the Corners, with well ſquared Stones, yielding both Strength and Grace; and ſo much touching the entire, or ſolid Wall.

The Intermiſſions are either Pillars, or Pilaſters, Pillars commonly called Columns, of them are five Orders, *viz.* The *Tuſcan*, the *Doric*, the *Ionic*, the *Corinthian*, and the *Roman* or *Compound* Order, or as ſome call it the *Italian*.

In which five Orders, I will firſt conſider their Communities, and then their Proprieties.

Their Communities are principally three, *viz.* firſt, they are all round; for though ſome conceive *Columna Atticurges*, mention'd by VETRUVIUS, to have been a Square Pillar, yet we muſt paſs it over, as irregular, never receiv'd among thoſe Orders, no more than certain licentious Inventions of wreathed and vined figured Columns.

Secondly, they are all diminiſh'd or contracted, inſenſibly, more or leſs, according to the Proportion of their Heights, from one third of their Shaft upwards, which PHILANDER doth preſcribe, by his own preciſe meaſuring of the antient Remainders, as the moſt graceful Diminution. And here I muſt blame a Practice familiar in ſome Places, of making Columns ſwell in the Middle, as if they were Sick of ſome Timpany, unſeemly to the very Judgment of Sight, and contrary to the Original, and Natural Type in Frize, which at firſt was imitated in Pillars, and VITRUVIUS himſelf obſerves.

Thirdly, they have all their Underſetting, or Pedaſtals in Height $\frac{1}{3}$ of the whole Column, comprehending the Baſe, Shaft, and Capital; and their upper Adjuncts, as Architrave, Frize, and Cornice, $\frac{1}{4}$ of the ſaid Column, according to JACOBO BORACCIO, who is deem'd a very good Author. Theſe are their moſt conſiderable Communities, and Agreements.

Their Proprieties, and Diſtinctions, will beſt appear by ſome reaſonable and plain Deſcription of them all, with their Architraves, Frizes, and Cornices.

Firſt therefore, the *Tuſcan* is a plain, maſſy, rural, reſembling ſome ſturdy, well limbed Labourer, home clad, as VITRUVIUS makes the Compariſon; the Length whereof ſhall be 6 Diameters, or as SCAMMOZZI makes it 6$\frac{1}{2}$ Diameters of the groſſeſt Part of the Column, being a very natural Proportion. The Diſtance or Intercolumniation may be near four of its own Diameters; becauſe the Materials commonly laid over this Column, were rather of Wood than Stone; through the Lightneſs whereof, the Architrave cou'd not ſuffer; tho' thinly ſupported, nor the Column itſelf being ſo ſubſtantial. The Contraction aloft, ſhall be (according to ſome Authors) $\frac{1}{4}$ of its Thickneſs below. To conclude, the *Tuſcan* is, of all, the rudeſt Pillar; its principal Character is Simplicity.

The *Doric* Order, is the Graveſt that hath been receiv'd into Civil Uſe; preſerving, in Compariſon of thoſe that follow, a more maſculine Aſpect; and little Trimmer than the *Tuſcan* that went before, ſave a ſober Garniſhment now and then of Lyons Heads, and Triglyphs and Métopas in the Frize. Sometimes likewiſe, but rarely, Channell'd, and a ſlight Sculpture about the Hypotrachelium; or Neck under the Capital; the Length 7 Diameters, and according to SCAMMOZZI 7$\frac{1}{2}$ Diameters; its Rank is the loweſt by all Congruity, as being more Maſſy than the three others; and ſo better able to ſupport the Intercolumniation 3 Diameters, the Contraction aloft, $\frac{1}{5}$ of the ſame Meaſure: He is beſt known by his Trimming, when he is in Company, and by the peculiar Ornament of his Frize when he is alone.

The

The *Ionic* Order reprefents a Kind of a feminine Slendernefs, not unlike a light Houfewife, but in a decent Matron-like Drefs. Its Length eight Diameters; in Degree as in Suftantialnefs next above the *Doric*; fuftaining the third, and adorning the fecond Story moft commonly. The Intercolumniation two Diameters; the Contraction above $\frac{1}{8}$; and is beft known by his Trimmings; for the Body of this Column is always channelled like a thick plaited Gown; his Capital dreffed on both Sides, not unlike Womens Wires in a fpiral Wreathing, which they call the *Ionian Voluta*; the *Cornice* generally indented; the *Frize* fometimes fwelling like a Pillow; thefe are his beft Characters.

The *Corinthian* is a Column lafcaroufly decked like a Courtezan, and therein participating (as Inventions do) of the Place where they were born. *Corinth* having been without Difpute, one of the wantoneft and moft luxurious Towns in the World. This Order is of nine Diameters; his Degree is one Stage above the *Ionic*, tho' with fome, the higheft of the civil Orders; the Intercolumniation $2\frac{1}{4}$ Diameters, which is of all the comlieft Diftance; the Contraction above ; in the Cornice are Dentils and Modillions; the Frize adorn'd with all Kinds of Figures and various Compartments; the Capital cut into the beautifulleft and lovelieft Leaves that Nature yields, which is the *Acanthus*, or *Branca Urfina*, Bear's Foot. In fhort, as Plainnefs characterizes the *Tufcan*, fo muft Delicacy and Variety the *Corinthian* Pillar.

The laft is the *Compounded*, or the *Roman* Order, his Name being a Brief of his Nature, for this Pillar being nothing in Effect, but a Medly of all the precedent Orders, and tho' the moft richly trimm'd, yet the pooreft in this, that he is a Borrower of all his Beauty; his Length is a Mean between the *Ionic* and *Corinthian*, according to SCAMMOZZI; tho' fome will have him the higheft, as of 10 Diameters. The Intercolumniation about two Diameters, or fomewhat lefs; the Contraction above $\frac{1}{8}$ lefs above than below; his Degree with fome is the higheft, but few Palaces either ancient or modern exceed the third of the civil Orders. You may eafily know him by the Mixture of his Ornaments, and fo much touching the five Orders of Columns, which I fhall conclude with two or three, not impertinent Cautions.

Firft, That where more than one of thefe Orders fhall be fet in feveral Stories, there muft fpecial Care be taken to place the Columns precifely one over another, that fo the Solid may anfwer to the Solid, and the Vacuity to the Vacuity, as well for the Beauty as Strength of the *Fabrick*; and by this Caution the Confequence is plain, when we fpeak of the Intercolumniation or Diftance which is due to each Order, we mean in a *Doric*, *Ionic*, and *Corinthian* Porch, or Cloifter, or the like, of one Contignation, and not in florid Buildings.

Secondly, Let the Columns above be $\frac{1}{4}$ lefs than below, faith VITRUVIUS, which appears a ftrange *Precept*, and would feem reafonable rather to make them $\frac{1}{4}$ bigger, becaufe, according to the Optick Rule, the higher they are, the lefs the Diminution aloft fhould be, becaufe the Eye naturally contracts all Objects more or lefs, according to their Diftance; but VITRUVIUS acquits himfelf like a wife *Mechanic*; the natural Reafon to go before the Mathematical; that therefore they above fhould be $\frac{1}{4}$ lefs than thofe beneath, that they may the better fuftain them.

Thirdly, That all the projecting or jutting Parts (as they are termed) be very moderate; efpecially the Cornices of the lower Orders; for while fome think to give them a beautiful and royal Afpect by their Largenefs, they fometimes both hide the Light within, and detract much from the View of the Front without. I need fay no more here concerning Columns and their Adjuncts, only anfwer one familiar Objection.

It will perchance be faid, that this Doctrine touching the five Orders, were fitter for the Quarries of *Afia*, which yielded 127 Columns 60 Feet high to the *Ephefian* Temple; or for *Numidia*, where Marble abounds, than for the Spirits of *England* or *Ireland*, who muft be content with more ignoble Materials; to which I anfwer, that this need not difcourage us, for one may fee at *Venice*, an Antiporch after the *Greek* Manner raifed by A. PALLADIO upon eight Columns of the *Roman* Order; the Bafes of Stones without Pedeftals; the Shafts or Bodies of meer Brick $3\frac{1}{2}$ Feet in Diameters thick below, and confequently 35 Feet high; than which no Columns can appear more ftately of the fame Height, either of Stone or Marble; for the Bricks having been firft formed in a circular Mould, and then cut before they were burned, into 4 Quarters or more, the Sides afterwards joined fo clofely, and the Points concentre fo exactly, that the Columns appear one entire Piece; which fhort Defcription I would not omit, that thereby may appear, how in Truth, we want Art rather than Stuff, to fatisfy our greateft Fancies.

After Columns, the next in Order are Pilafters, which are a ftrong and noble Kind of Building, PALLADIO *noteth*, and others agree with him, that their true Proportion fhould be an exact Square; but for leffening an Expence, and enlarging of Room, they are commonly narrower in Flank than in Front, their principal Grace confifts in half, or whole Columns applied to them; in which Cafe, 'tis well noted by *Authors*, that the Columns may be allowed fomewhat more than their ordinary Length, becaufe they lean unto good Supporters. For a particular Defcription of them, See *Sect.* III. Part II. of this Book.

Now becauſe they are oftener, both for Beauty and Majeſty, found arched than otherwiſe, I am here orderly led, to ſpeak of Arches; and under the ſame Head, of Vaults, for an Arch is nothing indeed but a contracted Vault, and a Vault is but a dilated Arch. Therefore, to handle this Buſineſs both compendiouſly and fundamentally, I will reſolve the whole Buſineſs into a few *Theorems*.

Theor. I. All ſolid Materials, free from Impediment, deſcend perpendicularly downwards, becauſe that Ponderoſity has a natural Inclination to the Centre of the World, and Nature performeth her Motions by the ſhorteſt Lines.

Theor. II. Bricks moulded in their ordinary Rectangular Form, if they ſhall be laid one by the other in a level Row between any Supporters ſuſtaining the two Ends; then all the Pieces between them will neceſſarily ſink, even by their own natural Gravity; and much more if they ſuffer any Depreſſion by other Weights above them; becauſe their Sides being parallel, they have Room to deſcend perpendicularly without Impediment according to the former *Theorem*; therefore to make them ſtand we muſt either change their Poſture, or their Figure, or both.

Theor. III. If Bricks moulded, or Stones ſquared cuneatim (that is wedge-wiſe) broader above than below, ſhall be laid in a Row level with their Ends, ſupported as in the precedent *Theorem*, pointing to one Centre, then, none of the Pieces between can ſink 'till the Supporters give Way; becauſe they want Room in that Figure to deſcend perpendicularly: But this is yet a weak Piece of Structure, becauſe the Supporters are ſubject to much Impulſion, eſpecially if the Line be long; for which reaſon, this Form is ſeldom uſed but over narrow Doors, or Windows, therefore to fortiſy the Work, as in this third *Theorem*, we have ſuppoſed the Figure of all the Materials different from thoſe in the ſecond; ſo likewiſe we muſt now change the Poſture, as will appear in the *Theorem* following.

Theor. IV. If the Materials figured as beforeſaid, wedge-wiſe, ſhall not be diſpoſed levelly, but in Form of ſome Arch or Portion of a Circle, pointing all to the ſame Centre, in this Caſe, neither the Pieces of the ſaid Arch can ſink downwards for want of Room to deſcend perpendicularly, nor the Supporters or Buttements, as they are termed, of the ſaid Arch can ſuffer ſo much Violence as in the precedent Poſture, for the Roundneſs will always make the incumbent Weight rather to reſt upon the Supporters, than to ſhove them, whence may be drawn an evident *Corollary*, that the ſafeſt of all Arches is the Semicircle, and of all Vaults the Hemiſphere, tho' not abſolutely exempt from ſome natural Weakneſs, as BARN. BALDI, Abbot of *Guaſtalla* in his Comment on ARISTOTLE's Mechanics, does very well prove; whence I note, that when any thing is mathematically demonſtrated weak, it is much more mechanically ſo; Errors evermore occuring more eaſily in the Management of groſs Materials than lineal Deſigns.

Theor. V. As ſemicircular Arches or hemiſpherical Vaults being raiſed upon the total Diameter, be of all others the roundeſt, and conſequently the ſureſt by the precedent *Theorem*; ſo theſe are the gracefulleſt, which keeping preciſely the ſame Height ſhall yet be diſtended $\frac{1}{7}$ longer than the ſaid entire Diameter, which Addition of Diſtent will confer much to their Beauty, and detract but little from their Strength. This Obſervation is found in LEON BAPTISTA ALBERTI, but the Practice how to preſerve the ſame Height, and yet diſtend the Ends of the Arch, may be ſeen in *Prob.* 36. in Practical Geometry in Book I. of this Treatiſe.

Upon theſe 5 *Theorems*, all the Skill of Arching, and Vaulting, is grounded; as for theſe Arches, which our *Artizans* call, of the third and fourth Point; and the *Tuſcan* Writers DI TEZZO, and DI QUARTO ACCUTO, becauſe they always concur in an accute Angle, and ſpring from the Diviſion of the Diameter, into three, four, or more Parts at pleaſure: I ſay, theſe both for the natural Imbecility of the ſharp Angle itſelf, and likewiſe for their very Uncomlineſs, ought to be exiled from judicious Eyes, and left to their firſt Inventers the *Goths*, or *Lombards*, amongſt other Reliques of that barbarous Age.

Thus of my firſt Partition of the Parts of every *Fabrick* into 5 Heads; having gone through the two former, and being incidently carried into this laſt Doctrine touching Arches, and Vaults, the next now in Order, are the Apertions, under which Term I comprehend Doors, Windows, Stair-Caſes, Chimnies, or other Conduits, in ſhort, all Inlets, and Outlets, to which belong two general Cautions.

Firſt, that they be as few in Number, and as moderate in Dimenſion, as poſſibly may conſiſt with other due Reſpects, for in a Word, all Openings, are Weakenings.

Secondly, that they don't approach too near the Angles of the Walls; for it were indeed a moſt eſſential Soleciſm to weaken that Part which muſt ſtrengthen the reſt, a *Precept* well recorded, but ill practiſed by the *Italians* themſelves; particularly at *Venice*, where may be ſeen divers *Pergoli* or *Miniana*, (as VETRUVIUS ſeem'd to call them) which are certain balliſ'd Out-Standings to ſatisfy the Curioſity of Sight, very dangerouſly ſet forth upon the very Point of the Mural Angle.

Of Doors, and Windows, thoſe Inlets of Men and Light I couple together, becauſe I find their due Dimenſions are brought under one Rule by LEON ALBERTI, who from the School of PYTHAGORAS (where it was a fundamental Rule, or Maxim, that the Images of all Things were latent in Numbers) both determine the comelieſt Proportions between the Breadths, and Heights, namely, the

Symmetry

Symmetry of 2 to 3 in their Breadths and Length, in Orders the Double, as 2 to 4, there will indubitably result from either, a graceful and harmonious Contentment to the Eye; our Master VITRUVIUS seems to have been an extreme lover of luminous Rooms; and indeed I must confess that a frank Light can misbecome no *Edifice*, yet on the other Side, we must take heed not to make a House all Eyes like ARGUS, which in Northern Climates, wou'd be too cold, in Southern too hot; besides, there is no Part of a Building more expensive than Windows, or more Ruinous, not only for the vulgar Reason, as being expos'd to all Wind, and Weather, but because of consisting of so different and unsociable Pieces, as Wood, Iron, Glass, and those small, and weak, and easily shaken.

Of Doors, there is this Distinction, some we call *Fores*, some *Valvæ*; those, as the Word may seem to import, did open outwards, these inwards, and were commonly of 2 Leaves, or Panes (as we call them) thereby requiring indeed a lesser Circle in their Unfolding, and therefore much in Use among the *Italians* at this Day; but I charge them with an Imperfection, for tho' they let in as well, yet they keep out worse.

Of Stair Cases; to make a compleat Stair Case, is a curious piece of Work; the vulgar Cautions are these,

I. That it may have a liberal Light against all Casualties of Slips, and Falls.

II. That the Space above the Head be large and airy, because one spends much Breath in ascending.

III. That the half Paces be well distributed at competent Distances for reposing on the Way.

IV. That to avoid Encounters, and besides, to gratify the Eye of the Beholder, the whole Stair Case have no niggardly Breath, that is for the principal Ascent in Royal Buildings, at the least 10 Feet.

V. That the Breadth of every single Step be never less than one Foot, nor more than 18 Inches.

VI. That they exceed by no Means, six Inches in Height, or Thickness, for our Legs labour more in Elevation, than Distention.

VII. That the Steps be laid where they join, somewhat Sloping, that the Foot may in a sort ascend and descend, which, though observed by few, is a secret and delicate Deception of the Pains in Mounting.

Lastly, to reduce this Doctrine, to some natural, or at least mathematical Ground, VITRUVIUS borrows the Proportions which make the Sides of a Rectangular Triangle, that is, three for the Perpendicular, from the Stair Head to the Ground, 4 for the Ground-Line itself, or Recess from the Wall, and 5 for the whole Inclination or Slope in the Ascent.

There are likewise spiral or cockle Stairs, and sometimes running about a Pillar, sometimes Vacant, wherein PALLADIO (a Man very expert in this Point) was wont to divide the Diameter of the first sort into three Parts, yielding one to the Pillar, and two to the Steps; of the Second into 4, of which he gave 2 to the Steps, and 2 to the Vacuity, which had all their Light from above, and this in exact Oval is a Master Piece,

Of Chimnies, the *Italians* who make frugal Fires, are not in this Case the best Counsellors, therefore, from them, we may better learn how to raise fair Mantles within, and how to disguise gracefully, the Shafts of Chimnies abroad, therefore, I shall lay down the Observations of PHIL. DEL ORME, a Man, diligent in this Part of Work.

First, he observes that who in the Disposition of the Building will consider the Regions, and the Winds that ordinarily blow from this, and that Quarter, might so cast the Rooms which need most Fire, that he shou'd little fear the Incommodity of Smoak; but if the Error lies in the Structure itself, then he makes a logical Enquiry, that either the Wind is too much let in above at the Mouth of the Shaft, or the Smoak is stifled below. If none of these, then there is a Repulsion of the Fume, by some higher Hill or Fabrick, that overtops the Chimney; likewise if not this, then he concludes that the Room is little and close, so as the Smoak cannot Issue, wanting a supply of Air, and so having the natural Reason of the Cause, we may apply a suitable Remedy.

Thus having consider'd the Apertions, and Overtures, according to their particular Requisites; I come to the whole Work under the Term of Compartitions, into which, being the principal Things to be considered, I cannot enter without giving a few Precautions.

First, let no Man that intendeth to Build, settle his Fancy upon a Draught of the Work on a Piece of Paper, how exact soever measured, or neatly set off in Perspective, without a Model or Type of the whole Structure, and of every Parcel or Partition in Paste-board, or Wood.

Next, that the said Model be as plain as may be without Colours, or other beautifyings, lest the Pleasure of the Eye, pre-occupate the Judgment.

Lastly, the bigger this Type is, the better; not that I wou'd advise one to such an Enormity, as the Model made by ANT. LABACCO of St. PETER's Church in *Rome*, containing 22 Feet in Length, 16 in Breadth, and 13 in Height, and costing 4184 Crowns; the Price of a reasonable Chappel; yet in a *Fabrick* of 30 or 40000 £. may be expended in an exact Model 50 £; for a little

Penury

Penury in the Premises might easily breed some absurdity of a far greater Expence in the Conclusion.

Now coming to the Compartitions, the Gracefulness will consist in a double Analogy, or Correspondency; first, between the Parts of the whole; whereby a great Fabrick shou'd have great Compartitions, great Lights, great Entrances, great Pillars, or Pilasters, in short; all the Parts great. The next Thing between the Parts themselves, not only considering the Breadth, and Length, as before when we spoke of Doors, and Windows, but likewise their Height; a Point hardly reducible to any general Precept.

Let us conceive a Floor or Area of a goodly Length, for Example; at least of 120 Feet, with the Breadth somewhat more than half the Length; about the two longest Sides, and Head of the said Room, shall run an Order of Pillars, which PALLADIO supposes *Corinthian*; supplying that Point out of *Greece*; the fourth Side I will leave free for Entrance: On the foresaid Pillars was laid an Architrave, which, VITRUVIUS mentions alone, PALLADIO adds thereunto, and with Reason, both Frize, and Cornice, over which went up a continual Wall, and therein half or three quarter Pillars, answering directly to the Pillars below, but one quarter less, and between those half Columns above the whole Room, was Window'd round about.

Now from the lowest Pillars, there was laid over a Contignation, or Floor, borne upon the outward Wall, and the Head of the Columns with a Terras, and Pavement *sub dio*, says our Master, and so indeed he might safely determine the Matter in *Egypt*, where they fear no Clouds, therefore PALLADIO (who leaves this Terras uncover'd and ballifs'd about) did perchance construe him rightly, though therein declining from others. Always we must understand a sufficient Breadth of Pavement left between the open Part of the Windows, for some delight to Spectators that might look down into the Room; the Breadth I have suppos'd contrary to some former Position, is a little more than ½ the Length, because the Pillars standing at a competent distance from the outmost Wall, will by the Interception of Sight, somewhat in appearance diminish the Breadth, in which Case, Discretion may be more licentious than Art. This is the Description of an *Egyptian* Room, for Feasts, and other Jollities; about the Walls of which, we must imagine entire Statues plac'd below, and illuminated by the descending Light from the Terras, as likewise from the Windows between the half Pillars above; so this Room had abundant and advantageous Light; and besides other Garnishing, must needs receive much State by the Height of the Roof, that covers two Orders of Columns.

Now for the Roofing, being full Time for the House to put on his Cap. There are two Extremities to be avoided in the Cover or Roof; *viz.* that it be not too heavy, nor too light; the first will suffer a vulgar Objection, of pressing too much the under-Work; the other contains a more secret Inconveniency; for the Cover is not only a bare Defence, but likewise a kind of a Bond, or Ligature to the whole Fabrick, and therefore wou'd require some reasonable Weight; but of the two; a heavy Roof is the Worse; next, there must be a care of Equality, that the Edifice be not press'd on one Side, more than the other; and here PALLADIO wisely advises, that the inward Wall may bear some good Share in the Burden, that the outward be the less charged.

Thirdly, the *Italians* are very careful in giving the Cover a graceful Pendance, or Slope, dividing the whole Breadth into nine Parts, whereof two shall serve for the Elevation of the highest Top, or Ridge, from the lowest; but in this Point, the Quality of the Region is to be consider'd; for as our VITRUVIUS intimates, those Climes that fear the falling and lying of much Snow, ought to provide more inclining Pent Houses; and Comliness always must yield to Necessity. Of Roofing at large. See *Section* VIII. Part II. Plates 33, 34, 35, of this Book.

Of proper *Materials* for Building any *Edifice*, with the requisite *Scantlings* of the *Timber*, &c.

First of Timber, the Timber most useful for Building, are Oak, Fir, and Elm; but chiefly the two first; namely, Oak for Outside-Work, and Fir for Partitions, Doors, and Floors. These Timber Trees ought to be felled in Autumn, or any Time of the Winter Season, because then the Trees recover from the Roots, that Strength and Soundness, which in the Spring, and Summer, was dilated into Leaves, and Fruits; and the best Time for to fell Timber is in the Wane of the Moon; because the Moisture (which is most apt to rot Timber) is then consum'd.

Your Timber being fell'd, let it be remov'd to some Place free from the Extremeties of the Sun's Heat, and also, from the Wind, and Rain.

Timber ought not, especially Oak, to be wrought very wet, nor too dry; for too wet makes it apt to rot, and too dry, harder to Work; and it will not be dry enough to saw into Planks for Door-Cases, and Windows, in less than three Years.

Timber is commonly sold by the Load, which contains 50 Cubical Feet, and each Foot 1728 Cubical Inches, and 20 Solid Feet, saw'd into such Scantlings as shall hereafter be prescrib'd, will compleat the Square of 10 (which is 100 Feet) of the outside Carcass, of any ordinary Timber Building.

The Price of the Load of rough Timber, fit for Building is very uncertain, as, from 20 *s.* to 50 or 55 *s.* the Load.

Rough Timber bought for Building, is to be ſaw'd into ſeveral Scantlings, greater or leſſer; according to the largeneſs of the Structure therewith to be erected; and the ſeveral Members belonging to the Erection of any Building, are as follows,

Summers, or Girders, Joiſts at full Length, to bear in the Wall.

Binding and trimming Joiſts, Wall Plates, or Beams, and Purlynes, principal Rafters, ſingle Rafters, principal Diſcharges to reſt on the Peers.

Theſe ſeveral Members (whether Oak or Fir) are to be ſaw'd in their Squares, according to their Lengths, as the Largeneſs of the Building ſhall require; and theſe Scantlings following, are fitted for all Edifices great or ſmall,

As *Summers*, or *Girders*, in *Length*.

From 14 to 16 Feet, muſt be in their Square, 11 and 8 Inches.
From 16 to 20 Feet, muſt be in their Square, 15 and 9 Inches.
From 20 to 25 Feet, muſt be in their Square, 14 and 10 Inches.
From 25 to 26 Feet, muſt be in their Square, 16 and 12 Inches.
From 26 to 28 Feet, muſt be in their Square, 17 and 14 Inches.

Joiſts at full *Length*, to bear in the *Wall*. In *Length*,

12 Feet muſt be in their ſquare, 4 and 8 Inches.
$11\frac{1}{2}$ Feet muſt be in their ſquare, 3 and 7 Inches.
$10\frac{1}{2}$ Feet muſt be in their ſquare, 3 and 6 Inches.

Binding or *Trimming Joiſts*, in *Length*,

7 Feet muſt be in their ſquare, 6 and 5 Inches.
9 Feet muſt be in their ſquare, 7 and 5 Inches.
12 Feet muſt be in their ſquare, 8 and 5 Inches.

Wall Plates, and *Beams*, in *Length*,

15 Feet muſt be in their ſquare, 7 and 5 Inches.
16 Feet muſt be in their ſquare, 8 and 6 Inches.
17 Feet muſt be in their ſquare, 10 and 6 Inches.

Purlins in *Length*, from

$15\frac{1}{2}$ Feet to $18\frac{1}{2}$ muſt be in their ſquare, 9 and 8 Inches.
$19\frac{1}{2}$ Feet to $21\frac{1}{2}$ muſt be in their ſquare, 12 and 9 Inches.
$21\frac{1}{2}$ Feet to 24 muſt be in their ſquare, 14 and 10 Inches.

Principal *Rafters* in *Length*, from

$12\frac{1}{2}$ Feet to $14\frac{1}{2}$ one Side cut taper, from 8 to 5 Inches, and thick on the other Side, 6 Inches.
$14\frac{1}{2}$ Feet to $18\frac{1}{2}$ one Side cut taper, from 9 to 7 Inches, and thick on the other Side, 7 Inches.
$18\frac{1}{2}$ Feet to $20\frac{1}{2}$ one Side cut taper, from 10 to 8 Inches, and thick on the other Side, 8 Inches.
$21\frac{1}{2}$ Feet to $24\frac{1}{2}$ one Side cut taper, from 12 to 9 Inches, and thick on the other Side, $8\frac{1}{2}$ Inches.
$24\frac{1}{2}$ Feet to $26\frac{1}{2}$ one Side cut taper, from 13 to 9 Inches, and thick on the other Side, 9 Inches.

Single *Rafters*, in *Length*,

$6\frac{1}{2}$ Feet muſt have in their ſquare, 4 and $3\frac{1}{2}$ Inches.
8 Feet muſt have in their ſquare, $4\frac{1}{2}$ and $3\frac{3}{4}$ Inches.
$9\frac{1}{2}$ Feet muſt have in their ſquare, 5 and 4 Inches.

Principal Diſcharges of any Length from 10 Feet and upwards (to reſt upon Peers of Wood or Stone, in the firſt Story of Brick Buildings) muſt have in their Squares, 13 and 12, or 14 and 13 Inches.

The Timber being thus prepared for your Buildings, theſe Rules are to be obſerv'd in the Diſpoſition of them.

I. That no Timber be laid within 12 Inches of the Fore-ſide of any Chimney Jaumb.

II. That all Joyſts on the Back of any Chimney, be laid with a Trimmer, at 6 Inches Diſtance from the Back.

III. That no Timber be laid within the Funnel of any Chimney.

IV. That no Joiſts, or Rafters be laid at greater Diſtance, one from each other, than 12 Inches; and no Quarters at greater Diſtance than 14 Inches.

V. No Joiſts ought to bear at longer Length than 10 Feet, nor ſingle Rafters more than 9 Feet.

VI. All Roofs, and Frames for Windows, ought to be of Oak.

VII. No Summers, or Girders ought to lie leſs than 10 Inches into the Brick Wall, no Joiſts leſs than 8 Inches.

VIII. No Summers or Girders, ought to lie over the Head of Doors, and Windows, in Brick Buildings.

The Estimates and Rates of the several Artificers Work, *who are employed in any Building.*

The Framing of Roofs is valued at 4 or 5 *s.* in the square, more than the Sides, Floors, and Partitions.

The Boarding of Floors, is a Work, distinct from the Timber Flooring, and is measured by the square of 10 Feet, and the common Allowance for Workmanship, is 4 or 5 *s.* per square, besides Nails, of which 200, that is 240 is a competent Allowance.

Of other Carpenters Work, such as Doors made of plain Deal, and rabited, for Stuff and Workmanship, valued at 3 or 4 *d.* per Foot superficial, but doubled Doors, batton'd, and wainscotted, may be worth about 7 *d.* per Foot, for the Case of such Doors above mention'd, in the Price, you may raise or fall at Pleasure.

Shop Windows, are usually agreed for, as plain, or batton'd Doors, besides the Iron Works.

Window Frames, are usually agreed for by the Number of Lights contain'd in each Frame, allowing 3 *s.* per Light, for Stuff and Workmanship.

Of *Stairs*, and *Stair-Cases.*

An ordinary Pair of Stairs, of about 6 or 4 Feet, with Flyers, and Winders, made of Elm Boards, are worth 2 *s.* 6 *d.* per Step, for Stuff, and Workmanship; but for Workmanship alone 9 *d.* is sufficient; but for Stair Cases, which have an open Newel, from the Top, to the Bottom, with a Landing at every 6th, or 8th, Step, and the going being about 3½ Feet all the Way, these Stairs, with Rails, and Ballusters, String-boards, Posts, Balls, and Pendants; and such other Ornaments may very well be worth 4, 5, or 6 *s.* per Step.

There are divers other Timber Works, belonging to Buildings, which are done by the Carpenter, Carver, and Joiner, *viz.*

Doors, and Door Cases, with their Ornaments; outside Doors, and Door Cases, Cornices, and Guttering, Cantilivers, and Modillions, plain Cornices, Pediments over Doors, Spurs, Piers, Pilasters, &c. of these some are valued by the Piece, dearer, or cheaper, according to their Largeness, Goodness of Stuff, and Curiousness in the Workmanship; others are measured and rated by the Foot, running Measure, of which, more hereafter.

Of *Bricks*, and *Bricklayers Work*

Bricks are made of reddish Earth, which ought to be dug before Winter, but not made into Bricks, 'till the Spring Season; the Goodness of Brick Earth is various; and the well ordering of it is as uncertain.

In every Brick Kiln or Clamp, are three sorts of Bricks; those next the Fire are best burn'd, and such as have naturally much Nitre, or Salt Petre in them, will, with the Violence of the Fire, run as if glazed over; and this Sort, some call Clinkers; the next to those in the Kiln, are best for common Uses; the outermost in the Clamp are the worst, where the Salt Petre is not digested for want of Heat; and these will moulder away like Dirt, with the least Moisture, and this sort they call Samel, or Sandal Bricks; and it is observable that, while Bricks are burning, that the Side of the Clamp next the Wind, are the worst of all, the Heat being driven from thence.

The general Rates for making of Bricks, is 4 *d.* 5 *d.* or 6 *d.* per Thousand, for the Moulder only; and a Day's Work is commonly 900; but a dextrous Workman will make about 1500 a Day.

The Moulds in which Bricks are moulded, should be (by the Statute) within, in Length 9 Inches, in Breadth 4½ Inches, and in Depth 2½ Inches; Bricks made in such a Mould, will be less, and lighter, yet, they shrink but little in Thickness, in Breadth less, and in Length undiscernable, the common Weight of one Brick is about 5 *lb.* and will contain in solid Measure 90 Inches Cubical, and from some Moulds 100; 13 of them will make one solid Foot.

Note, the more Mortar is us'd in Brick Building, the worse the Work will be.

18 Inches at the Bottom for any common Building, about two Stories high, is sufficient; but for large or high Buildings, of three, four, or five Stories high, with Garrets, ought to be to the first Water Table 28 Inches at the least; but as for the Partitions, 1½ is Brick sufficient.

Chimneys in Buildings, are sometimes measur'd and paid for by the Rod, or else paid for by the Hearth.

Of *Laths*, and *Lathing*, for *Tyling.*

Laths for Tyling, ought to be Heart of Oak, of which the Statute approves of two sorts, the one of 4 and the other of 5 Feet long, and sold by the Bundle, not differing in Quality, but in Quantity, the longer Sort, having but 5 Score to the Hundred, the shorter, 6 Score.

To the Longest, 500 Lath Nails is the common Allowance, and to the shortest 600.

One Bundle of the longest Laths extended, makes 500 Feet; every of these Laths ought to be in Breadth 1½ Inch, in Thickness ½ Inch.

Of Laths are three Kinds, namely, Heart of Oak, Sap Laths, and Deal Laths, from 1 *s.* to 2 *s.* 6 *d.* per Hundred, or Bundle; the two last Sorts are us'd for Cieling, and Partitions, and the first for Tyling only.

The

The Proportions for Tylers Lathing are various; as sometimes $3\frac{1}{2}$, sometimes 4 Inches, and in both, there ought to be a Counter Lath between every two Rafters; to 1000 Tyles is allow'd usually, one Peck of Tyle-pins from 2 to 4 Shillings per Bushel; 4 Bushels of Lime, and 6 or 8 Bushels of Sand, will make Mortar, sufficient for to lay 1000 Tyles, and 60 Tyles will cover one square Yard, at a 7 Inch Gage.

Of *Tyles*.

Tyles are of several Sorts, but all made of the same Earth, but better than Brick Earth, and something near the Potter's Earth, according to the Statute of EDWARD the IV. *Chap.* IV. Earth for Tyles, shall be cast up before the first of *November*, shired and turned before the first of *February*, and not made until the first of *March*, and shall likewise be tryed and severed from Stones, Marle and Chalk.

Of *Plain Tyles*.

By the forement, ion'd Statute a plain Tyle shall contain in Length, $10\frac{1}{2}$ Inches, in Breadth $6\frac{1}{4}$ Inches, and in Thickness, $\frac{1}{2}$ Inch, and $\frac{1}{2}$ Quarter at least; 1000 of them make one Load, and for the making of 1000. 2 *s.* or 2 *s.* 6 *d.* is an usual Price.

Of *Roof*, or *Ridge Tyles*.

These Tyles shou'd contain in Length, 13 Inches, and in Breadth, $8\frac{1}{2}$ Inches, and in Thickness as above, they are sold at 20 *s.* per 100.

Besides these, there are other Tyles made properly for Gutters in Cross Buildings, in Valleys, and gather'd Ends, *&c.* they are in the Form of Triangles, circular at their Bases, and about 10 Inches deep; there are Corner Tyles also, which are made more flat than the others, and rounded off at the Angle above, to lie the closer and better on the Sleeper, they have Pin-holes in them, at the Acute Angle; these are generally sold at 2 *d.* or $1\frac{1}{2}$ *d.* a Piece.

Of *crooked Pan*, or *Flemish Tyles*.

These are used in covering of Shades, Lennies, and all kinds of flat roofed Buildings; these Tyles are, for the most Part laid dry, yet sometimes pointed within Side; they are usually in Length, $14\frac{1}{2}$ Inches, in Breadth $10\frac{1}{2}$; the Laths on which they hang, by a Knot of their own Earth, are 10 or 12 Feet in Length, in Breadth $1\frac{1}{2}$ Inch, and in Thickness, 1 Inch; they are commonly sold at 2 *d.* per Lath; the Gage for nailing those on with six-penny Nails, is $10\frac{1}{2}$ Inches, their Breadth when laid, $8\frac{1}{2}$ Inches; one Lath serves for one Yard square of Tylings, and 15 Tyles; and 10 Laths, will cover one Square, their Price is about 7 or 8 *s.* per 100.

Of *Lime*, *Sand*, and *Mortar*.

Stones whereof Lime is made, either dug out of Hills, or taken out of Rivers; the best Lime is made of the hardest, found and white Stone; and being burnt remains $\frac{1}{3}$ lighter than the Stone: All dug Stones are better than gather'd Stones; and from a shady and moist Pit, than from a dry; all Stones are sooner or later burnt, according to the Fire that is given them, but commonly in 60 Hours. Stones being burnt, wet them, but pour not on all the Water at once; but at divers times, and frequently, that they may not burn, till they be well-temper'd; afterward put them in a shady Place without any Moisture; only cover them lightly with Sand, and by how much the more they are steeped, so much the more tough and better they will be.

Of Sand, there are three Sorts, *viz.* Pit Sand, River Sand, and Sea Sand; Pit Sand, is of all the best; of all Pit Sand, that which is found in the falls of Water, is best; because it is most purged, the Sea Sand is the worst of all; the Pit Sand, because it is fat and tough, is us'd in Walls, and Vaults; the River Sand is very good for covering, or rough casting of Walls, all Sand is good in its Kind; if being squeezed and handled it crackles, and put upon a white Cloath, it neither stains, nor makes it foul; that Sand is bad, which mingled with Water, makes it dirty and muddy.

For to make Mortar, you must so mix the Sand, that taking of Pit Sand, you must mix $\frac{3}{4}$ thereof, with $\frac{1}{4}$ of Lime; if River, or Sea Sand $\frac{2}{3}$ to $\frac{1}{3}$ of Lime, will be sufficient.

The common Allowance for Lime is, 8 Bushels heaped measure, to 10000 Bricks.

Of *Slate* and *Slating*.

Covering with Slate, is very neat, especially with blew, cut into long Squares, or Scallops, and usual in Summer, or Banqueting Houses in Gardens; but as this Cover is neat and handsome, it is also very chargeable; for Roofs cover'd with Slate, must be first boarded over; the Slates hung upon Tacks, and laid with finer Mortar than Tyles; this kind of covering with Slates, is valu'd by some from 3 *s.* to 6 *s.* the Yard square.

Of *Shides*, or *Shingles*.

Shingles, called also, Slates, or Shides of Wood, are quartered Oak Boards, saw'd to a certain Scantling, but usually left about an Inch thick at one End, and made like a Wedge, about 4 or 5 Inches broad, and 8, or 9 Inches Long; 31 Shingles, and the like Number of Nails, will cover a Yard square.

Of

Of *Lead*.

Of Lead, there are three Sorts, white, black, and ash Colour, the white is more perfect and precious, than the black, and the ash Colour, between both; Lead is dug either in great Lumps, found by themselves, or in small Pieces, which Shine, with a certain Blackness, or else in very thin Flakes, among the Rocks; all sorts of Lead will easily run, because with the Heat of the Fire, it melts before it be red hot; and put into a very hot Furnace, it loseth its Nature and Strength; for one Part is changed into Litharge, and the other into Dross; of these sorts of Lead, the black is the softest; and therefore easily wrought with a Hammer, or Mallet, it dilates much, and is very heavy; the white is harder and lighter; the ash Colour is much harder than the white, and of a middle Weight between both; Lead is generally laid flat to walk on, allowing the Water a little fall to the Battlements, thence privately to descend in Pipes; and 112 *lb.* will cover one Yard square.

Of *Iron*.

The Uses of this Metal, are many; for of it are made Nails, Hinges, Door Chains, Grates, Dogs, Hangers for Signs, Balconies, Locks, Jacks, Spits, *&c.*

Of *Pargetting*.

Pargetting, or Plaistering is of divers Kinds, as (1) with Lime, and Hair Morter laid upon bare Walls, at 3 *d.* or 4 *d.* the Yard, (2) upon bare Laths, as in partitioning and plain Cieling, from 8 to 14 *d.* the Yard square, rendering on Partitions at 2 or 3 *d.* per Yard; rough casting upon Heart Laths from 1 to 3 *s.* the Yard square; Plaistering upon Brick Work, with finishing Mortar, in Imitation of Stone Work, from 1 to 2 *s.* per Yard square, or more; and the like upon Heart Laths, at $1\frac{1}{2}$, 2, or 3 *s.* per Yard square.

In all these Scaffolds are to be considered, and the Quantity of Lime and fine Sand, for finishing Mortar, must be equal.

Of *Priming*, or *Painting*.

Painting of outside Works, as Doors, Shop-Windows, Window-Cases, Pediments, Architraves, Frizes, and Cornices, and all other Timber Works, which are expos'd to the Weather, ought at first setting to be primed with Spanish Brown $\frac{2}{5}$, Spanish white $\frac{2}{5}$, and red Lead, about $\frac{1}{5}$, to make the other two Colours dry, well ground with Linseed Oil, will make excellent Primer; and lastly, with fair white, made of white Lead, and about $\frac{1}{5}$ in Quantity, not in Weight, of Spanish Brown.

Outside Work thus colour'd, may be afforded for 3 *d.* or $3\frac{1}{2}$ *d.* the Yard square, for each Time laid over.

Window Frames are valued at 3, 4, or 6 *d.* the Light, and Casements at $1\frac{1}{2}$ *d.* per Frame; Iron Bars, at 1 *d.* per Bar.

Of *Paving*, the *several Sorts* thereof.

Paving with rough, or rag Stone, is the cheapest of all Pavements, valued from 12 to 15 *d.* per Yard square.

Paving with Pebble Stones laid in Gravel, for Materials and Workmanship, may be worth 15 or 16 *d.* per Yard.

Paving with common Brick, which is commonly us'd for Cellars, Wash Houses, Sinks, Hearths, and such like, 30 whereof will pave a Yard square.

Paving with Flemish Brick, which is far neater than common Brick; they are of a yellowish Colour, and must be laid in Sand; each Brick is $6\frac{1}{4}$ Inches long, $2\frac{1}{2}$ Broad, and $1\frac{1}{4}$ Inch thick; allowing $\frac{1}{4}$ for the Joints; 72 of them will pave a Yard square, but if they be set Edge-wise, 100 will pave 1 Yard square, which will cost 3 *s.* 4 *d.*

Paving with square Tyles, which are of several Sizes, *viz.* 6, 8, 10, and 12 Inches, in Value from 6 to 20 *s.* per 100.

Paving with broad Stone taken out of the Quarry, in value, 6, 7, or 8 *d.* per Foot square.

Paving with Rigate (alias Fire-Stone) is good for Chimneys, Fire Hearths, Ovens, Stoves, *&c.* which is dearer than common Purbeck Pavement.

Paving with Marble, is, of all other, the most Beautiful, whereof are several Sorts, as white, black, and gray.

Rules to be observed in the Measuring of all the Works belonging to the several Artificers, *relating to the Building of any* Edifice, *either great or small.*

Carpenters Work.

Are generally Flooring, Partitioning, and Roofing, all which are measur'd by the Square of 10 Feet, which contains in superficial Measure 100 Feet.

There are other Works belonging to Carpenters, which are measured by the Foot, running Measure, and such are these, *viz.*

Rails

Rails and Ballufters,	Breaft Summers,	Window Lights,
Dormer Lights,	Skirt Boards,	Balcony Doors, and Cafes,
Cantaliver Cornices,	Timber Fronts,	Pediments,
Modillion Cornices,	Pentices,	Columns, or Pillars,
Plain Cornices,	Shelving,	Pilafters,
Guttering,	Benching with Bearers,	Stair Cafes,
Lintelling,	Doors, and Door Cafes,	Mantle Trees, and Teffels.

All which are rated at fo much a Piece.

Note I. In meafuring of Flooring, after you have meafur'd the whole Floor, you muft make Deductions out of the fame for Well-holes, Stairs, and Chimneys; and in Partitioning, you are to make Deductions for Doors, and Door Cafes, and for Windows, if any there be; except by Contract they are to be included.

Note II. In meafuring of Roofs, there are feldom any Deductions made for the Chimney Shafts to pafs, the Vacancies of Lutheran Lights, and Sky Lights; for they are more Trouble to the Carpenter, than the Stuff that wou'd make them good, is worth.

Note III. In meafuring the Timber Frame of any Floor, you muft add 9 Inches to the Length, or Breadth, where the Joifts are let into the Brick Work, and one Foot of Timber for every Girder's End, let into the Wall.

Of *Plaifterers Work.*

Plaiftering, whether Work lathed and plaiftered, or rendering upon Brick Work, *&c.* are meafured by the fquare Yard.

Note I. If there be any Chimney Ways, in your Cieling, or Door Ways, or Windows in your Partitioning, you are to make Deductions for them.

Note II. When you render upon Brick Work, there is no Deduction to be made for Doors or Windows, for the Jaumbs, and Heads, commonly exceed in Trouble, fuch Vacancies.

Note III. That whiting and colouring, are meafured as Ceifing Rendering were.

Of *Joyners Work.*

Joyners meafure their Work by the Yard fquare, but in taking the Dimenfions of their Work, they have a Cuftom, and fay we ought to meafure all our Work that the Plane touches, wherefore, in taking the Height of any Room, where there is a Cornice and fwelling Pannels and Mouldings, they ufe with a Line to girt over every Member of fuch Cornice and fwelling Mouldings, which will make the Room to girt higher than in Reality it is; but for meafuring about the Room, they only meafure it as a Flat.

Note, That in meafuring the Joyners Work, you are to make Deductions for all Window-Lights; but you muft meafure the Window-boards, Sapheta-boards, Checks or Jaumbs, and Skirt-boards by themfelves.

Of *Painter's Work.*

The taking of Dimenfions for the Painter's Work within Doors, is the fame with that of the Joiner's, by girting the Mouldings and Members of Cornices, *&c.* and it is but reafonable they fhould be paid for that upon which both their Time and Colours were fpent.

All the Difference between Painters, and Joyners, in taking their Dimenfions, is this, *viz.* that the Joyners muft be paid for Work, and half Work, in the meafuring of the Doors, Windows, Shutters, Cup-boards, Doors, Drawers, and fuch like Works as are wrought on both Sides of the fame Stuff.

Of *Glaziers Work.*

Glaziers meafure their Work by the Foot fquare, and it is to be *noted,* that when Windows have Rounds at the Top, they meafure them at the full Height, as if they were fquare; alfo round or oval Windows, are meafured at the full Length of their Diameters; likewife, Crocket Windows in Stone-Work; and there is good Reafon for fo doing, for the Trouble in taking the Meafures to make them by; the Wafte of the Glafs in cutting them, and the extraordinary Time expended in fetting them up, is more Valuable, than the Glafs which wou'd fill up a Square of the fame Bignefs.

Of *Mafons Work.*

Mafons Work is meafured by the Foot, either fuperficial, or folid.

Of *Brick-layer's Work.*

The principal Works done by Brick-layers about Building are, Walling, Tyling and Chimney-works, to which I may add paving with Bricks and Tyles.

Tyling is meafured by the Square of ten Feet, as Flooring, Partitioning and Roofing, in Carpenter's Work; fo that a Houfe covered with a plain Roof, the Difference between the Roofing and Tyling is not much; yet the Tyling will be more, for the Tyles go beyond the Roof at both Ends over the Gable Ends, and are ftruck with Lime and Hair Mortar, and they alfo hang fomewhat over the Eve-

boards on either Side, if the Houſe ſtands alone; and again, in ſome Roofs there are many Hips and Valleys, for which the Brick-layer will require running Meaſure; for the which in ſome Caſes he ought to be allowed, but for the moſt Part he is not.

Of *Walling*.

Brick-layers meaſure their Walls (and other, their, Work) by the Rod ſquare, each Rod containing 16 ½ Feet in Length, whoſe Square is 272.25 ſuperficial ſquare Feet.

There is, moreover, to be obſerved in Brick Work the reducing of which from any Thickneſs to a Standard, or Statute Thickneſs; for in Walls, and Foundations of an Houſe, the Walls are of different Thickneſſes, all which muſt be reduced to one Standard, which is, 1½ Brick. To do which, take this for a general Rule, *viz.* multiply the Number of ſuperficial Feet, that are found to be contained upon the Superficies of any Wall, by the Number of ½ Bricks, which that Wall is in Thickneſs; one third Part of the Product, ſhall be the true Content of that Wall, reduced to one Standard Thickneſs, of 1½ Brick.

Of *Chimneys*.

Firſt, if the Chimney to be meaſured, ſtands ſingle, and alone, the uſual way is to girt it about, and if the Jaumbs are but one Brick Thick, and wrought upright over the Mantle-tree, to the next Floor, then girt about for the Length, and the Height of the Story for the Breadth, all one Brick thick.

PART II.

More particular Directions relating to *Architecture*, chiefly collected from different AUTHORS.

SECTION I.

Of the ORDER of COLUMNS, with uſeful *Remarks*, and *Obſervations*.

Of the TUSCAN ORDER. Fig. 1. Plate I.

TO the whole Height of this *Order*, I give 11 Modules 40 Minutes, which I divide into 15 equal Parts, 3 whereof I give to the Pedeſtal, 10 to the Shaft of the Column, including Baſe and Capital, and 2 to the Entablature; which I ſubdivide into 15 other equal Parts, of which, I give 4 to the Architrave, 5 to the Frize, and 6 to the Cornice: I alſo ſubdivide the Pedeſtal into 15 equal Parts, 3 of which I give to the Baſe or Zocle, 10 to the Die, and 2 to the Cornice; the ſame Proportion I aſſign to the reſt of the Columns, with an additional Increaſe of 50 Minutes to the Height of each *Order*, from the *Tuſcan*, to the *Corinthian*, which makes the whole Height thereof, to be 15 Modules, or Diameters, taken in the groſſeſt part of the Shaft.

Of the *Conſtruction* of this *Order*.

To *Conſtruct* this *Order*, draw the Baſe Line A B, next the Perpendicular C D, which will be the Axis of the whole *Order*, and make a Scale, as may be ſeen in the ſame Plate, divided into Modules, that is, into equal Parts, or Diameters of the Column, and ſubdivide the firſt Diviſion into 60 Minutes. This done, take 2 Modules, 20 Minutes from the Scale, for the Height of the Pedeſtal C G; 7 Modules 46⅔ Minutes for the Height of the Column G H, and 1 Module 33⅓ Minutes, for that of the Entablature H D; the reſt according to the Meaſures expreſs'd in the Figures of Plate II.

Thus

Thus much I thought proper to add by the way, to ſhew the *Novice* how he is to begin to make the Deſign of an *Order*, which I imagine to be ſufficient, to enable him, without any further Inſtructions, not only to continue in this *Order*, but alſo to conceive the *Conſtruction* of the other *Orders*; ſuppoſing that every one, who applies himſelf to the Study of Architecture, has already acquired Geometry enough to enable him to comprehend the whole at half a word.

Of the *Intercolumniation*. Plate II.

In this Plate, where the Columns are without Pedeſtals, and without Portico's too, on the Left-hand Side, there are three ſeveral Spaces, or Diſtances, reckoning from Centre to Centre of the Columns, at which they may be placed, *&c.* a large, mean, and a ſmall Diſtance: The firſt ſhews the leaſt Space which can be reaſonably interpoſed between the Columns of this *Order*, when they follow each other two by two; and the ſecond and third ſhew the Spaces that may be between them, when they follow one another, one by one.

The greateſt Diſtance between thoſe Columns, when they follow each other, one by one, ſhou'd not exceed $3\frac{1}{4}$ Modules.

In Plate III. are alſo ſhewn the Meaſures for the Diſtances of thoſe Columns, when they are found in Portico's, or Arches. It is not however to be ſuppoſed, that theſe Proportions are ſo preciſe, as that they may not be varied a few Minutes, when Occaſion ſhall require; but the leſs the Variation is, the better it may be.

The Column is compoſed of 3 Parts; *viz.* the Baſe, the Shaft or Fuſt, and the Capital.

Of the *Shaft*.

The Shaft always terminates at the Top of an Aſtragal, and at Bottom, with a Fillet, or Cavetto revers'd.

Of the *Capital*.

The *Capital* of the *Tuſcan* Column, only, conſiſts of three Parts; an Abacus, a Quarter-round, and a Gorge, or Neck, which terminates under the Quarter-round in a Fillet; the Aſtragal underneath belonging to the Shaft.

Of the *Baſe*.

This *Baſe* conſiſts only of two Members, or Parts, *viz.* a Plinth, and Torus: The Plinth is a flat ſquare Body, the Torus, a Body, flat on one Side, and of the other round. The Fillet above the Torus, belongs to the Shaft.

Of the *Entablature*.

The *Entablature* conſiſts of three principal Parts; a Cornice, a Frize, and an Architrave. To the Cornice I give $\frac{2}{5}$, to the Frize $\frac{1}{3}$, and to the Architrave $\frac{4}{15}$ of the whole *Entablature*.

Of the Projecture of the *Cornice*.

It is an eſtabliſh'd Rule with moſt Architects, that the *Cornice* of the *Entablature* ſhou'd have its Projecture, equal to its Height; and yet the Projecture may be ſafely made a little larger on Occaſion; particularly, where a beautiful Profile is required, as is here done in VIGNOLA's Manner.

Of *Portico's*, or *Arches*.

It is the ordinary Proportion of *Arches*, that the Height be made double the Width; but this may be varied; and made a little more, or leſs, as Occaſion ſhall require.

When the *Arches* are to be at ſome Diſtance from each other, for the Conveniency of any Apartments, either above, or underneath, the Columns which ſeparate them, ought to be in Couples, but when they are in Couples, they ſhou'd have but one Pedeſtal, if they have any Pedeſtal at all.

Of the *Pedeſtal*.

The Die of the *Pedeſtal*, ſhou'd be always equal in Breadth to the Plinth of the Baſe of the Column; excepting the *Pedeſtal* be without Baſe and Cornice, as it frequently happens: In which Caſe, it is neceſſary that it ſhou'd be a ſmall matter broader, in order to diſtinguiſh it from the Baſe of the Column.

Of *Columns* inſerted, or let within in the *Wall*. Plate III.

There are ſome Occaſions, wherein an Architect cannot give his Building a ſufficient Projecture; particularly where the Entablature would hinder the Sight of the Windows above, or intercept the Light of the Apartments below. In theſe Caſes, the Columns may have $\frac{1}{4}$ or $\frac{1}{3}$ of their Diameter, inſerted, or let into the Wall behind them; but recourſe ſhou'd never be had to this Shift, excepting in Caſes of Neceſſity; for the *Columns* here, loſe an infinite deal of that Beauty, and Grace, which they have when they ſtand alone.

It frequently happens too, that the *Columns* are let within the Wall, for the greater Solidity, and the further Strengthening of the Building. This however, ought to be obſerv'd, that they never loſe above $\frac{1}{3}$ of their Diameter; the Reaſon of which, will appear when we come to ſpeak of Impoſts.

Of the DORIC ORDER. Fig. 2.

In the Compoſition of this *Order*, we may diſcern ſomething extremely bold, and noble; its Entablature is pretty much like that which VIGNOLA gives us; and which he owns to have taken from ſome ancient Fragments. The Pedeſtal is $2\frac{1}{3}$ Modules high, the Column $8\frac{5}{6}$ Modules, and the Entablature $1\frac{1}{3}$ Module, ſo that the whole Height is 12 Modules 30 Minutes.

Of the *Intercolumniation*.

The Diſtances of Columns, are not left to Diſcretion in this *Order*, as in the *Tuſcan*. The Triglyphs which make the Ornaments of this Column, with their Metopes, being confined to certain Meaſures, put it frequently out of the Power of the Architect, to place his Columns at the Diſtances he might otherwiſe chuſe: However, by taking the Liberty which is done here, of diſpenſing a little with the ordinary Proportions of thoſe Triglyphs, and their Metopes, a Man has the *Intercolumniation* in his Power; and yet without giving the leaſt Offence to the niceſt Judges of Architecture, by ſuch Change of Proportions. By Proportion I don't here mean, a Relation of Ratio's, as the Geometricians do, but a Suitableneſs of Parts, founded on the good Taſte of the Architect.

Of the different Diminutions of *Columns*.

All *Columns*, with moſt Architects, begin to diminiſh in Thickneſs, from $\frac{1}{3}$ of their Height; but in Proportion as their *Orders* are moſt delicate, their Diminution ought (in my Opinion) to be leſs Senſible. For inſtance, in the *Tuſcan Order*, according to my Diminution, is diminiſhed at the Top, near the Aſtragal, by $\frac{1}{5}$; the *Doric* by $\frac{1}{6}$; the *Ionic* by $\frac{1}{7}$; the *Compoſite*, and *Corinthian* by $\frac{1}{8}$; that is the Diminution of 4 Mintues on each Side of the Axis.

Of the *Flutings* of the *Doric Columns*.

The *Fluting* of this *Column* ought not to exceed 20, which is the Number obſerv'd by VIGNOLA; PALLADIO, indeed has 24, but they appear too ſlender for this *Order*. Theſe ſhou'd always be ſo diſpoſed, as that there may be one to ſtand full in the middle of the *Columns*, VIGNOLA determines their Depth by an equilateral Triangle, having one of its Angles, in the middle of the *Fluting*. VITRUVIUS will have their Depth to be the middle of a Square, one of whoſe Sides is the Width of the *Fluting*, which laſt indeed, is the deeper of the two.

Where there are *Flutings* in this *Column*, there ought alſo to be Eggs, and Anchors, in the Quarter-round of the Capital; and even Pears and Olives in a Baguette, to be made underneath in lieu of Anulets. Theſe Eggs, and Anchors, ought to be in the ſame Number with the *Flutings*, and to correſpond regularly with them.

Of the *Mutules*. Plate IV.

In this Figure may be ſeen, how *Mutules* make a Corona to the Triglyphs underneath, each Triglyph having its *Mutule*.

Obſervations.

Thoſe who uſe *Mutules*, uſually make them the ſame Breadth with the Triglyphs; but it wou'd be much better, if they were made of the ſame Breadth with the Capital of the Triglyphs.

It may be alſo obſerv'd here, that the *Mutules* don't run ſo near the extremity of the Larmier, or Drip, as is uſually done; but that there is a Space of three or four Minutes, left between the two, that the Profile may appear the more Diſtinctly, and the ſame Rule is obſerv'd in the *Modillions* of the other *Orders*.

Of the *Triglyphs*. Plate IV.

The ordinary Proportion of *Triglyphs*, is 30 Minutes in Breadth, and 45 in Height: But in regard theſe Meaſures occaſion a Diſproportion in the Intercolumniations of Portico's, a Thing particularly obſervable in VIGNOLA, who makes the Pillars there $2\frac{1}{2}$ Modules broad, whereas the others are but 2; I have accommodated the Proportion of mine, I mean of my *Triglyphs*, to that of the Intercolumniation, thinking it more reaſonable to make the little Parts correſpond to the greater, than the greater to the little: And yet I believe it will be own'd, that my *Triglyphs*, tho' different from the Ordinary ones, are not inferior to them in Beauty.

Of the *Metopes*. Same Plate.

By *Metopes* are meant, the Intervals between the Triglyphs. The Beauty of thoſe conſiſts in their regularity; that is, in their being perfect Squares: And yet when they are really Square, they appear to be leſs in Length, than in Breadth, which is owing to the Projecture of a little Bandelet, wherein they terminate underneath, that hides a ſmall Part of their Height: For this Reaſon, I make the *Metopes* a Minute or two more in Height, than in Breadth; being of Opinion, they ought rather to appear Square without being ſo, than really be Square without appearing ſo.

Obſervation.

When the *Triglyphs* and *Metopes* follow each other regularly, the Columns muſt ſtand one by one, exempting thoſe of the inner Angles, which ought always to be accompanied with two others, one on each Side; from which the reſt of the Columns may be placed at equal Diſtances from each other;

other; and it is to be obferved, that thefe two Columns, which accompany that of the Angle, are not lefs neceffary on Account of the Solidity of building, than of the Regularity of the Intercolumniation.

Inftead of a Column in the Angle, one may place a Pilafter, which will contribute more to the Strength of the Building. Columns ftanding alone, and diftributed one by one in a Ground Story, ought to have no Pedeftals; for thefe would make them appear too flender and weak.

Of the *Pedeftal.* Plate IV.

When Columns are placed two by two, as it is fometimes found neceffary, the regular placing of the Triglyphs in the inner Angle muft be a little interrupted, in order to keep up to the Regularity of the Parts of the Cieling. And, in Lieu of a little Part of a Triglyph in the Angle, may be placed the Arms of the Family, or fome other fuitable Ornament to cover the Defect.

In a Periftyle, confifting of Columns placed one by one, with *Pedeftals* underneath, one fingle *Pedeftal* may ferve for all the Columns; that is, the fame *Pedeftal* muft be continued throughout: But then the *Pedeftal* ought to be diftinguifhed into two Parts, a fore and an hind Part, by Breaks anfwering the Plinths of the Bafe of each Column; fo that each Column may feem to have its feveral *Pedeftals.*

When Columns that have *Pedeftals* are ufed in Porticos, they may ftand one by one; becaufe in that Cafe they are fupported and fortified by the Pillars of the Portico.

Profile of the *Doric Entablature* with its Parts and Names. Plate V.

A. The great Cimaife or Ogee with its Nofe.
B. Baguette.
C. Corona, with its Fillet over it.
D. Little Ogee, or *Cima inverfa.*
E. Plat-band.
F. Mutule view'd in Front.
G. Mutule viewed Sideways.
H. Quarter-round, with its Fillet underneath.
I. Capital of the Triglyph.
K. Triglyph.
L. Part of a Metope.
M. Triglyph, view'd Sideways.
N. Tenia, or Bandelet.
O. Guttæ, or Drops.
P. Upper Facia of the Architrave.
Q. Lower Facia of the Architrave.

Names of the principal Parts of the *Soffit* of the *Cornice.* Plate VI.

A B C. An angular Frame, or Pannel, containing three Rofes.
D E F. Bottom of a Mutule.
G. A little Modillion contriv'd under the Mutule, in the middle of the Drops, which make a double Row around it.
D. A little Border, containing the Drops of the Mutule.
H. A large Border which furrounds the Pannels of the Mutule.
I. A Plan of the Triglyph.
K. Plan of the upper Part of the Column.
L. Section of a Mutule view'd Sideways.

Of the *Impofts.* Plate VI.

Impofts are little Cornices which terminate the Pied-droits of Portico's, and are peculiarly appointed to receive the Extremes of their Arches, with their Architraves, or Head-bands.

Here are two Defigns of *Impofts*, different in Height, and Projecture: The firft for Portico's where the Columns have no Pedeftals, and the other for Portico's where they have, that is, the little *Impofts* are for little Arches, and the large *Impofts* for large Arches; it being highly reafonable, that the Bignefs of the *Impofts* fhou'd be proportionable to that of the Portico.

Obfervation.

Care muft be taken, that the Projecture of the *Impofts*, never exceeds the Semi-diameter of the Column behind, nor intercept any thing of its Roundnefs before.

Of the IONIC ORDER, Fig. 3.

This Order is of a delicate Compofition, with regard to the preceding Ones. Its Column is 8 Modules, $53\frac{1}{3}$ Minutes high; its Pedeftal 2 Modules, 40 Minutes; and its Entablature, 1 Module, $46\frac{2}{3}$ Minutes; the whole *Order* is 13 Modules, 20 Minutes high.

Of the *Intercolumniation.* Plate 8.

The Diftances of the Columns in this Order, are adjufted by a certain Number of Denticles, which leave a convenient Space between them; with this Circumftance, that there is always found one in the Middle, of each Column: Thus, when I mention 37 Denticles between the Axes of the Columns A and B; it muft be underftood, that there are 36 whole ones, and 2 halves; one at each Extreme; the firft Denticle A, and the laft B, being each cut into 2 equal Parts, by the continua-

tion of the Axes of the Columns. Whence it may be obſerv'd, that in Caſe there be a Neceſſity for augmenting, or diminiſhing the Inter Columns, it muſt be done by augmenting, or diminiſhing the Number of theſe Denticles, which, however, ought never to exceed one or two Denticles at the moſt.

Of the *Cymaiſe*, or *upper large Moulding*, that terminates the *Entablature*. Plate VIII.

I uſually make the Projecture of the *Cymaiſe*, equal to its Height, excluſive of the Fillet at Top.

Of the *Corona*, and its *Larmier*; or *Drip*.

The *Corona* is that large ſquare Moulding, immediately under the Cymaiſe. It projects very much, both for the greater beauty of the Entablature, and for the better ſheltering of the whole *Order*.

I uſually make this Part ſtronger than the Cymaiſe, as being the ruling Member of the Entablature, and even of the Order. Underneath this we uſually dig a Channel, for three Reaſons; the Firſt, to give it more Grace and Ornament; the Second, to render it leſs heavy; and the Third, to prevent Rain, or Moiſture from trickling down along the *Order*; for the Water falling from the Top of the Cornice, not being able to Aſcend into the Channel, is forc'd to fall drop by drop on the Ground; and it is on this Account, that the Bottom of the *Corona* is call'd *Larmier*, or *Drip*.

Of the *Ovolo*.

The quarter Round underneath the Larimer, is ordinarily called *Ovolo*; from the Figures of Eggs frequently Carved upon it.

Of the *Aſtragal*, or *Bagguete*.

The *Aſtragal*, or *Bagguete*, has the Figure of a Staff; when it is join'd to a Fillet, I divide the Height into 3 Parts, 2 whereof I give to the *Aſtragal*, and one to the Fillet.

This *Aſtragal* is frequently Carv'd with Pearls, and Olives.

Of the *Denticles*. Plate IX.

The *Denticles* is that ſquare Moulding, underneath the Ovolo; ſo call'd, becauſe out of this Member, the Architects frequently cut a kind of Teeth call'd *Denticles*, or *Dentils*.

The Diviſion of *Dentils* here, is ſo Order'd, that there is a *Dentil* found in the re-entering, as well as the projecting Angle; which occaſions a beautiful Regularity in the Soffit, not to be had in following the Manner of Vignola.

Thoſe who will have the *Dentils* repreſent the Ends of Rafters, will ſcarce approve my uſing them in Angles that have no Relation thereto: I ſhall beg, however, they wou'd conſider that they are here uſed no otherwiſe than as pure Ornaments; ſuch as in Effect they ought to be; and not as Ends of Rafters, which are never ſeen at all, excepting in Hutts, and Country Cabbins, or Cottages, which are Foreign to this Subject.

Of the *Capital* of the *Column*. Plate X.

The moſt eſſential Part of this *Capital* is the Volute, which ſeveral Architects imagine to have been intended to repreſent the Rind, or Bark of a Tree, incloſed between the Abacus, and Quarter-round, having its two Extremes twiſted into Scrolls, and thoſe two Scrolls bound with a large Rope in the Middle; which comes pretty near the Figure that the Ancients gave to the Sides of the *Capital*.

Other Architects conſidering that this *Capital* bears ſome Reſemblance to the Head-dreſs of a *Greek* Lady, believe it to have taken its Origen thence: But this being a Matter of no great Uſe, we leave every one to judge of it as he pleaſes.

Of the Manner of deſcribing the *Voluta*. Plate X.

There are various ways of Deſcribing the *Voluta*; but I ſhall content myſelf with giving one, which is the moſt uſual, as well as the moſt eaſy; being learn'd without any Trouble, by a bare View of the Figure. Some Architects blame it as not ſufficiently Accurate; but if managed with Addreſs, it anſwers very well.

The firſt Spiral A B C, *&c.* being drawn, deſcribe the Border, or ſecond Spiral, M N O, *&c.* taking new Centres near the Firſt, but ſtill approaching nearer to the Centre of the Eye of the *Voluta*, by a Square not exceeding that of a Point made with your Compaſſes.

Of the *Modern Capital*. Plate X.

The *Capital* of the Ancients being found improper in angular *Columns*, by Reaſon of the Diverſity of its Faces; Scammozzi Compoſed a new one with four ſimilar Faces, pretty much like thoſe in this Plate; ſome Architects, however, will not allow the *Volutas* to ſpring out of the Vaſe of the *Capital*, but will have them conſiſt of one and the ſame Rind continued under the Abacus, which by this means will appear the better ſupported, an Inſtance whereof, we have in the five *Orders* of Monſieur Perrault; and they wou'd have Reaſon on their Sides, were there the ſame good Taſte in this, as in the other Deſign; but that can't be, we muſt be content with the other, which is eaſily Deſigned, and has a beautiful Appearance. 'Tis true, the new Abacus which it has here, being better proportioned to the Largeneſs of the Volutas, than that of Scammozzi, renders it the

more

more graceful; besides that it is further enrich'd with little Festoons falling from the Volutas, which some modern Sculptors have been pleas'd to add.

When there are Eggs cut in its Quarter-round, their Number shou'd be 24, and the Shaft shou'd be channel'd with the same Number of Flutings.

Of the *Pedestal.* Plate VII.

Here are two Kinds of Cornices for the *Pedestal*, the one camus, to be used within Sides of Apartments where the *Pedestal* is to be viewed from above; the other has a Larmier, and is intended for *Pedestals*, whose Cornices are above the Eye, and are to be viewed from below.

Were an Astragal to be plac'd underneath the Cornice of this *Pedestal*, as we see done in that of the *Corinthian*, there shou'd be no Table in the Die; at least, if for any particular Reason, there were requir'd one, there must be no Astragal. Nor wou'd I ever allow an Astragal under a Cornice that is camus, and without a Larmier; but a Table hollow'd; a Table under the Astragal wou'd make too many little Mouldings one over another; and the Projecture of an Astragal under a Cornice without a Larmier wou'd make it appear too camus; whereas the Retreat of a Table will give it a Grace, and seem to augment its Projecture, and render it less camus.

Of the *Base* of the *Column.*

This is that Base call'd the Attic; which is, without Dispute, one of the most beautiful that was ever invented; its Height is 30 Min; its Parts are a Plinth 2 Torus's and a Scotia accompanied with 2 Fillets.

Of *Portico's* and their *Imposts.* Plate VIII.

The most perfect Arches are those which consist of a Semi-circle; and the Imposts are usually plac'd on a Level with their Centre. There are some Architects, however, who, from an optical Consideration, place them a few Minutes lower; and it is with Judgment they do it; for as the Projecture of the Impost hides a little Part of the Arch from the Eye, 'tis but reasonable it shou'd be lower'd a little, to leave the entire Semi-circle in view, which otherwise wou'd appear defective.

Of the ROMAN ORDER. Plate I. Fig. 4.

This Order resembles the *Ionic* in its Volutas, and the Base of its Column; but is much richer, and more ornamental. It has more Elegancy too, throughout the whole, as being somewhat higher, and yet it appears stronger, and more masculine, by Reason of its Modillions, and the Height of its Capital.

The Column is 9 Modules 26 $\frac{2}{3}$ Minutes high, the Pedestal 2 Modules 50 Minutes, and the Entablature 1 Module 53 $\frac{1}{3}$ Min. the whole Order containing 14 Modules 10 Minutes.

There is a particular Necessity for a close Adherence to these Measures and Proportions, when the Orders are so dispos'd, as that they may be compar'd together; as when one is plac'd upon another, where the Elegancy of each may be consider'd in regard to that of the other.

Of the *Intercolumniations.* Plate XI.

As in the *Ionic* Order, the Distances of the Columns are to be adjusted by a certain Number of Dentils; so in this Order, they must be adjusted by a certain Number of Modillions; with this Restriction, that there be always one exactly in the middle of each Column: The Intermodillions having been at first regulated by the Distances that ought to be between two Columns.

Of the *Convex Frize.*

We sometimes make the Frize of the Entablature Convex; but then, this shou'd never be done without some extraordinary Reason; meer caprice, being not sufficient to warrant such an Alteration.

When one Order is raised over another, and the upper Column has its due Bigness, its Pedestal necessarily goes beyond the naked of the under Column; which to some Persons has a disagreeable Effect. This inclines me to think, that the first Architect, who made a convex Frize, did it with a Design to extenuate this Appearance of a Defect. This is evident, that as the naked of the Friese is hidden by this Swelling, the Pedestal of the upper Order appears less to exceed the naked of the under Order. Were it not on this Account, the *Convex Frize* ought not to be imitated.

On the Occasion just mentioned, the Frize may be made convex in all the Orders, excepting the *Doric*, where this Swelling cannot be allow'd by Reason of the Triglyphs.

Of the *Capital.* Plate XVII.

In those two Designs we see the essential Parts of the Capital, their Measures and Proportions.

The First shews the Fig. of its Vase with the Height and Breadth thereof; here we may also observe, that the Abacus does not bear upon the Quarter-round, but only on the four Volutas,

which

which seems to be an Offence against Solidity; but which, however, is not very considerable, as being only in appearance, there being really no Space between the Abacus and Quarter-round; to which it may be added, that even this apparent Weakneſs is hid by the Volutas, and the little Leaves that accompany them, as you may ſee under the little Entablature. Plate XI.

In the ſecond Deſign we ſee the ſame Plan of the Abacus with its Horns, and how the equilateral Triangle A B C, gives the Point A, whence the Sweep or Curvity is to be deſcribed.

The Volutas of the Capital are ſomewhat leſs in this Order, than in the *Ionic.*

This Capital is uſually call'd *Compoſite*, as partaking of the *Doric* Order in its quarter-round, of the *Ionic* in its Volutas, and of the *Corinthian* in its double Row of Leaves underneath, which are in Number 16.

The Leaves that are propereſt for it, are *Laurel,* which not being much edged, or indented, are leſs delicate, and for that Reaſon more ſuitable to the Volutas of this Capital, which are tolerably maſſive, but agreeable to the Modillions of the Entablature.

Of the *Flutings.*

When we make *Flutings* in this Column, their Number is to be 24, as in the the *Ionic.*

Of the *Keys.*

Keys that have a Projecture, and are made in manner of Conſoles, and plac'd in the middle of Arches or Portico's, are particularly deſtin'd to ſuſtain the Weight and Preſſure of the Entablature, where it happens to be very great between the Columns; for this Reaſon, they ought to be made in ſuch manner, as that they may prove a real Support, and not to ſtand for meer Ornaments, as they frequently do. Without this Precaution, they had better be omitted.

Of the *Modillions,* Plate XIII.

The Meaſures that are obſerv'd in the *Modillions* both of this and the following Order, are not barely concerted with a View to the juſt Proportion of thoſe Parts, but alſo to eſtabliſh a Regularity in the Parts of the Soffit of the Cornice.

The Diſtance between one *Modillion* and another depends on that of the Inter-Columns; and that Diſtance obliges us to make the *Modillions* of a certain Height and Breadth, in order to have the Spaces that ſeparate them in the Soffit, perfectly ſquare. Not only becauſe thoſe Squares are more regular than long Squares; but alſo that they may be continued uniform thro' the projecting and re-entering Angles, which long Squares are incapable of; as may be obſerv'd in the Buildings made according to the Rules of VIGNOLA.

Further, in making the Diviſion of the Inter-modillions, Care muſt be taken that they have ſuch a Proportion, as that when the Orders are plac'd over one another, the *Modillions* of the lower Order be found in the ſame Number with thoſe of the Upper.

Of the little *Talons.* Plate XII.

When a little *Talon* or *Gula* ſerves as a Cymaiſe, particularly when it terminates an Impoſt, an Architrave or a Pedeſtal, I make its Fillet ſtronger, than when it is between two Mouldings, as between the Corona and the upper Cymaiſe of the Entablature; the former being more expos'd, it is more liable to be broken, beſides, they always appear more delicate than they really are, by reaſon of the Air, which ſeems to take ſomething of their Bulk.

Of *Pillars* or *Pied-droits.* Same Plate.

In Porticos where the Columns have Pedeſtals, the *Pillars* or *Pied-droits* ought to be two Modules in Breadth, but if they be more, they will be ill proportioned to their Columns; an Inſtance whereof, we have in the great *Compoſite* Portico of PALLADIO; towhich it may be added, that the Inter-columns in that Caſe, wou'd likewiſe be too big; as may be obſerv'd in the *Doric* Order of VIGNOLA, where the *Pillars* of his great Portico being of 2½ Modules, the Columns are found too far diſtant from one another.

PALLADIO terminates theſe *Pillars* with the Mouldings of the Baſe of the Pedeſtal, which he continues quite round; ſo that the Baſe of the Pedeſtal becomes confounded with that of the *Pied-droit*; a thing in my Opinion, that ought to be avoided. For, if theſe Mouldings be proportion'd to the Height of the Pedeſtal, they can't be ſo to that of the *Pillar*: Beſides, that by advancing a good way within the Paſſage, they become incommodious, and are ſoon broken or defaced.

VIGNOLA terminates theſe *Pillars* with a plain Zocle, which here ſuits very well; and this too is my practice.

When the Columns have no Pedeſtals, I terminate the *Pillar* with a Zocle equal to the Baſe of the Column; as may be ſeen in Plate XII.

Of

Of the CORINTHIAN ORDER. Plate I. Fig. 5.

In this Order we have yet more Delicacy than in any of the preceding ones. Its Column is 10 Modules high; its Pedestal 4 Modules, and its Entablature 2 Modules; so that the whole Height of this Order is fifteen Modules.

Of the *Denticles* or *Dentils.*

Tho' I divide the Denticles underneath the Ovolo, as in the *Ionic* Order, yet they might be left whole, because some may think, and with Reason, that the Modillions, the Eggs and the Dentils, may be too many considerable Ornaments together.

Of the *Flutings.*

Were we only to have regard to this Order, the *Fluting* of the *Ionic* Order wou'd suit it very well; but when it is to be erected either over the *Ionic* or *Composite* Order, then these Flutings may easily have an additional Ornament of a little Fillet running quite round.

Of the *Leaves* of the *Capital.* Plate XVII.

The Leaves of the Capital, when plac'd very high, may be those of Laurel, but when plac'd low, they may be those of either Olive, Acanthus, or Smallage; but the first, I mean the Olive ought to have the Preference of the two last; their Number is to be 16, *viz.* 8 in each row, the same as in the *Roman* or *Composite*, each Leaf is commonly divided into 7 or 9 Plumes, two whereof, or to speak more properly, one whole and an half on each Side, go to form the Return or Descent.

In making the Leaves of this or the *Roman* Capital, great Care must be taken they be well designed; particularly, that in dividing them into Plumes, that the Plumes don't run too far off from one another; but that all together appear to form one single Leaf, which must not be too narrow towards the Top; that each Plume directs to its Origin, *&c.* without which Precautions, the Leaves will lose all their Grace and Beauty,

If a *Corinthian* Order were to be plac'd very high, as in the Lanthorn of a Dome, I shou'd rather chuse not to divide the Leaves of its Capital at all, but to preserve the Mass entire. See Plate XVII.

In some Capitals we find Leaves that are very finely wrought, which, nevertheless, are of an extreme ill Taste, as those of Olive; for Instance, in the Pilasters of *V. de G.* This I mention by the way, for the sake of those, who, having no great Share of Judgment themselves, think they can't fail of doing well, if they do but imitate what they find in Buildings of Reputation.

Of the *Modillions* of this *Order.*

Underneath these *Modillions*, 'tis usual to have a Leaf that takes up their whole Breadth, and almost their whole Length too: But in my Opinion, the *Modillions* wou'd be more graceful, if this Leaf were less both in Length and Breadth. For this Reason, I enclose it between two little Lifts, wherein it seems, as it were, to be set, and out of which it never comes, but form its Return against the little Wave of the Modillion, which it joins without hiding: From this Relation of the Leaf with the Modillions, the latter is render'd exceeding graceful.

The Leaf of the Modillions ought to be of the same Kind with those which make the Ornament of the Capital; which is a Rule not to be dispensed withal.

Of the *Tables* or *Pannels* of the *Pedestal.* Plate XIV.

The Table in the Die of the Pedestal, ought to be equal to the Width of the Column; that is, one Module or Diameter; now the Width of the Die being 1 Module 24 Min. there remain 12 Min. for the Width of the Lift that goes round it; tho' towards the Bottom it must be somewhat wider; and may be pretty well fixed at 15 Minutes.

When these Tables are of Marble, I wou'd chuse to have them fix'd even with the Die; however, if they are to be sunk lower, the Inequality ought not ordinarily to exceed a Minute and an Half; in which Case, they shou'd have a Bagguette, or a little Talon, or Cavetto for a Border.

Some Architects bound these Tables with a little Border, projecting beyond the naked of the Die; but in my Opinion, they ought not to be imitated herein: Such a projecting Moulding or Frame agreeing very ill with the Astragal above it, and which it self projects nearly as much as the Bagguette that terminates the Bottom of the *Cornice.* To which it may be added, that so many little Mouldings being found almost at an equal Distance from one another, have an ill Effect, for it must be remember'd that the beautiful Distribution of Mouldings, consists in observing a Diversity in their Bignesses, as Figures and Distances.

Of the *Base* of the *Column.* Plate XIV.

This is the *Corinthian* Base, in most Respects like that usually given to this Order; its Height is 30 Min. and its Projecture beyond the naked of the Shaft 12 Min. as in the preceding Orders which have 2 Toruses.

The 2 Scotias of this Base plac'd one over another in like manner as the 2 Bagguettes that separate them, don't seem to be well concerted: In lieu of the two Bagguettes, I use here only one, which I believe will seem to every good Judge, to have a more agreeable Effect than the other, being less crouded with too many Mouldings.

Observation.

To raise an Order of Columns, a Module must be taken of such a Bigness, as that when the Pedestal is described in its proper Measures, the Cornice may not be found on a Level with the Eyes of those who pass by it; it being a Pain to the Sight, to bear projecting Bodies, just at its own Height, in as much as they seem to menace the Eye with a rencounter.

However, if any Difficulty shou'd occur in adjusting the Height of the Pedestals to that of Portico's, and Apartments that are to accompany them, one may retrench the Cornice and the Base, and then the Pedestal may be reduc'd to the proper Height, without any Restriction at all. See Plate LXII. Lib. V.

SECTION II.

Of PILASTERS with useful Observations.

PILASTERS are square Columns, as big at Top as at Bottom. These *Pilasters* are often used for mere Show, as when they appear inserted, or let within the Wall, not discovering above $\frac{1}{4}$ or $\frac{1}{5}$ of their Bigness. These Kind of *Pilasters,* which may be called flat *Pilasters,* are always found to have a better Effect than the others, which being entire, ordinarily appear heavy and lumpish.

When these *Pilasters* accompany Columns, they should have the same Height with the Columns in every Part, but if they be alone, I mean if they be not accompanied with any Columns, their Measures and Proportions are to be varied.

First, in the *Roman* or *Composite* and *Corinthian* Orders, the Capitals of *Pilasters,* to be well proportioned, shou'd be higher than those of Columns, as being broader. Whence it follows, that the Height of their Shafts ought also to be augmented in proportion.

Secondly, it may be observ'd in general, that a *Pilaster* made according to the Measures or Proportions of a Column, that is containing an equal Number of Modules in Height, appears much shorter with regard to the Breadth, than the Column, and the Reason is, that the Sides of the *Pilasters,* being flat, appear in their full Breadth, which is otherwise in the Column; the Shadow of whose Roundness, makes it appear slenderer than it really is, so that, to make a *Pilaster* appear with the Beauty of a Column, the Height of its Shaft must be augmented, as well as that of its Capital.

Further, the Capital of a *Pilaster,* being broader than that of a Column, and the Profile of the Entablature beyond the Naked of the *Pilaster* continuing nearly the same, the Modillions are found farther apart from each other, than in the Order of Columns: Whence it likewise follows, that the Distances given for the Intervals of Columns, adjusted by a certain Number of Modillions, will not serve for the Intervals of *Pilasters,* no more than they will for determining the Proportion of Portico's.

And Lastly, the Modillions being farther apart from each other, the Cornice ought to have a greater Projecture, in Order to have perfect Squares between them, whereon the Regularity of the Soffit depends.

'Tis necessary therefore to have particular Compositions for the Orders of *Pilasters,* distinct from those of Columns; for this Reason, I suppose the following ones, which answer to those of my Orders of Columns, I have not given any particular Designs for their Bases, nor for the Cornices and Bases of their Pedestals; the Proportions of which Parts may be taken from the Orders of Columns, and the Reason is, that as the Breadths of those Parts are not alter'd, neither shou'd there be any Alteration in their Heights, so that the Difference in Height between the Pedestals of Columns, and those of *Pilasters* will lie wholly in their Dies.

Of

Of the Projecture of *flat Pilasters.*

The ordinary Projecture of these *Pilasters*, beyond the Wall, is ten or twelve Minutes; but when they terminate faillant Angles of a Building, their Thickness, if practicable, may be regulated by the Parts of the Soffit, or Platfond of the Cornice.

Of the *Flutings.*

When *Flutings* are used in Pilasters, their Number shou'd be seven on each Side: The first and last whereof, may be a little farther from the Angle, than the rest are from each other; that the Extremities of the Pilasters may not be too much weakened.

In some old Monuments we find Pilasters which have only five *Flutings* on a Side; but then these are too Large, and make the Pilasters appear little and pitiful: And if they were Nine, they would be too fine and slender, even for the most delicate *Orders.*

We never make *Flutings* in the *Tuscan* Order; either Column, or Pilaster, and if by chance we make any in the *Doric*, (which however is very rare) we leave pretty large Spaces next the two Extremeties, in order to Strengthen the Angles.

One may add, either a single *Fluting* in the Projecture or Thickness of the Pillar, or leave it quite plain, provided it does not exceed 10 Minutes in Thickness.

Of the *Rudentures*, or *Fillings up* of *Flutings.*

By a *Rudenture* we mean the Figure of a Rope, or Staff-cut, on some occasions in the *Flutings*, to strengthen their Sides, and render them less liable to be broken. For Instance, when we make fluted Columns, or Pilasters without Pedestals; and place them on a level with the Ground, or at least so little rais'd, as to be within reach of the hand; their *Flutings* must be *rudented*, or cabled, (as they call it) as far as one third of their Height, that is, they must be filled up in part to that Height, with these *Rudentures* in order to strengthen the Sides, which might otherwise be soon defaced.

These *Rudentures* which were at first invented for Use, have been since converted into Ornaments, to enrich the *Flutings*; so that instead of plain substantial *Rudentures*, we now frequently see them exceedingly weak, and slender; being wrought in the Form of twisted Ribbons, Foliages, Chaplets, and other rich and delicate Ornaments.: But this kind of *Rudentures* ought never to be used, excepting in Columns, or Pilasters of Marble, and such as are beyond the Reach of the Hands of the People.

One may likewise, for the greater Richness, as well as for the greater Ease sake, make the Ornaments of Brass, and even of Brass guilt, to be fitted within the *Flutings.*

These delicate Ornaments are also found to succeed very well in Columns and Pilasters of Wood, where they are cut with a great deal of Ease and Justness.

Of *Ornaments* on the *Mouldings.*

Ornaments are not always us'd on *Mouldings* barely to enrich them, but sometimes also to distinguish them the better from one another.

As the Generality of *Mouldings*, and in particular those of Cornices, are only illuminated by Reflection, they wou'd be frequently confounded and lost, if they were all simple and uniform; but a few *Ornaments* cut on some ones, distinguish them from each other to Advantage. Thus, the Eggs have a noble Effect underneath the Larmier in the *Ionic* Order, or underneath the square Member, whence the Modillions proceed in the *Corinthian*: Because those *Ornaments* being cut strong, and bold, make an agreeable Difference between the Mouldings that accompany them.

Among these *Ornaments*, some stand Prominent from the *Mouldings*, and others are cut within them.

Of the *Mouldings* that are to have no *Ornaments.*

Ornaments are not to be bestow'd every where indifferently; some Members, or *Mouldings* must be reserv'd plain to set off the rest; and without the Simplicity and Plainness of these, the Richness of *Ornaments*, wou'd only make a Confusion in Architecture; a sensible Instance whereof we have in the *Corinthian* Profile, taken from the Baths of *Dioclesian*, and mentioned in the Parallel of M. DE CHAMBRAY.

The Corona, for Instance, is the first Master *Moulding* in the Cornice, which would not admit of *Ornaments*, and the Reason is, that it is followed with a Larmier, which is usually full of very rich Compartments, besides the Modillions which make one of the most considerable *Ornaments.* It may be observ'd, that I now only speak of the more delicate *Orders*; wherein *Ornaments* are the most proper.

The Faces of the Architrave ought also to be left plain, and particularly when the Frize is enriched.

All the Fillets, Lists, and Listels ought still to be without *Ornaments*; those being peculiarly destined to fix and enclose the Parts in the Mouldings, wherewith they are encompassed.

The Astragal ought always to be plain, excepting in the *Ionic* Order, where the Astragal of the Shaft is converted into a Chaplet of Pearls, and Olives, for the Capital.

All

All the Parts of the Base of the Column ought to be plain, in order to serve as a Rest to the *Flutings* of the Shaft. There are some Occasions however, wherein the Toruses may be enriched; of which we have a remarkable Instance in the new Chappel at *Versailles*, where it is done with a great deal of Prudence. For, as nothing shou'd be expos'd to the Eyes of a great Prince, but what is some way distinguished by its Richness; and as the King, here, has in Sight, the Bases of the Columns of his Seat; 'tis just they shou'd be enriched like the rest of the Chappel, which is extremely Pompous: The Nobleness of the Architecture, and the Beauty of the Painting, and Sculpture, shewing at the same Time the Magnificence, and Piety of the Founder. But setting aside such Occasions, it would be a Fault to adorn the Bases of Columns; tho' SCAMMOZZI is of another opinion.

We shall shew hereafter, what is to be observed with regard to the grand Distribution of Parts, plain, and enriched.

SECTION III.

Of particular Kinds of COLUMNS, and first of wreathed COLUMNS.

THESE kind of *Columns*, which are pretty well known by their Names, and are usually made very Rich, ought never to be used but in Places of Distinction, as in Altars, Tombs, Salons, and other Places, where Magnificence is required.

They shou'd never be us'd to support either Walls, or Vaults; or any other considerable Burthen; by reason of their Weakness; nor shou'd any thing be laid upon them beyond a plain, slight and delicate Entablature. For tho' they appear by their Circumvolutions, to have less Delicacy than the common Columns, yet in Effect they have less Solidity. This is evident from the Perpendiculars *a, b, c, d*, drawn by the Cavities of their Waves: The solid Space included betwixt the two, being considerably less in Diameter, than the *Column* G H, which however, is as Delicate as possible. See Plate XXIII.

The Manner of Describing the *Circumvolutions* of the *Column.*

Divide the Diameter of the Plan of the *Column* into three equal Parts, A C, C D, D B.

On the Division C D, as on a Diameter, describe a Semi-Circle C E D, and divide it into three equal Parts.

From the Divisions of this little Semi-Circle, draw Lines parallel to the Axis of the *Column* E F.

Draw a common *Column* as G H, of the same Height, and in the same *Order* as the wreathed *Column* to be Designed; but take care the *Order* be delicate.

Divide its Axis G H, into 48 equal Parts, which is easily done by dividing it first into three, then each of these into two, and each of these into two more; thus proceeding from two to two, 'till you get the whole Number 48.

Through these Divisions, draw Lines parallel, and horizontal. Then,

From the Points where these Parallels cut the Perpendiculars C I, D L, *&c.* describe the Spiral M, N, O, *&c.*

Through the Points of that Spiral, draw transverse Lines P Q, N R, *&c.* equal to the transverse Lines, 1, 2, 3, 4, 5, *&c.* and you'll have Points sufficient for describing your wreathed *Column.*

Remark.

The wreathed *Columns* in the high Altar of St. PETER's at *Rome*, have two Astragals, which divide the Height of the Shaft, into three Parts; but these are not to be imitated, excepting where there are particular Reasons for it.

Those in the Altar of the VAL DE GRACE, have an Astragal over the first third of their Height; which is a judicious Contrivance, to hide the Juncture, or setting on of the two Pieces, whereof each *Column* consists.

But what I think inexcusable both in the wreathed *Columns* of St. PETER, and those of the VAL DE GRACE, are the Flutings in the first third of their Height; for these render the lower Part of the *Column* more delicate than the upper; which is the more visible, by Reason of the Foliages, and Ornaments, that run along the upper Parts; and by their Relievo, seem to encrease in its Bigness: For this Reason it had been better, in my Opinion, to have fluted the upper Part; and either to have charged the lower Part with Foliages, or to have left it quite plain and uniform.

Another thing to be censured in the Altar of the VAL DE GRACE, is the Entablature which is distributed Piece-meal over each *Column*; and a continued Entablature would doubtless have done much better.

Of

Of *Symbolical Columns,* and *Human Figures.* Plate XXIII.

The Ancient *Greeks,* to preserve the Memory of their Victories, had a Custom in the *Columns* of their public Buildings, to add *Figures,* and Representations of the Enemies they had subdued. The Wives of the rebellious *Carians,* when reduced to Obedience, and the *Persians* vanquish'd by the *Lacedemonians* at *Platæa,* were the first Subjects of these *Columns,* which have preserved to late Posterity, both the Glory of the Victors, and the Dishonour of the Vanquished.

Hence Originally came the Names *Cariatides,* and *Persian Columns,* which have been since applied to all *Columns* made in *Human Figures,* tho' with Characters very different from one another.

We don't now represent the *Cariates* as formerly, with the Marks of Servitude and Slavery. Such Characters being injurous to the Fair Sex; and for that Reason we give them others entirely opposite; never using them in Buildings, but as singular Beauties, and such as make the greatest Ornaments thereof. They never make their Appearance now, but under the noble Symbols of Prudence, Wisdom, Justice, Temperance, Fortitude, *&c.*

When *Cariates* are insulate, they should not have any Weights to support greater than those of Balconies, little Galleries, or slight Coverings, and their Entablature may be the *Ionic.*

The *Cariates* should always have their Legs pretty close, the one a little a-thwart the other, with their Arms either join'd to the Body, or to the Head, or at least very little asunder; that as they do the Office of *Columns,* they may, as much as possible, bear the *Figures* of them.

There is this particular Defect in the Cariates; that being the *Figures* of Women, they do not seem altogether proper to do the Office of *Columns*: But this is easily amended when they join to a Wall, there being nothing to be done in that Case, but to place a Console over them, which shall appear to bear all the Weight of the Entablature; which will have a good Effect; and the Cariates will serve for *Columns,* without appearing over burthened.

If the Cariates have a Projecture beyond the Wall, in the Manner of Pilasters, they may be used in the Architecture of a Gallery, or Salon, provided they be not made to sustain any thing but the Entablature; the Weight of the Vault being borne by the Wall behind, which serves them as a ground Bottom.

The Cariates should never be made of any immoderate Stature; lest being too big, they become frightful to the Ladies. For this Reason, one wou'd sometimes chuse to confine them under the Impost of a Portico; such Imposts serving them for an Entablature. Further, on Occasion, one may raise them on Pedestals, which however, must not have less than $\frac{1}{3}$ of their Height. And if besides this, One places Consoles over their Heads, the Figures may be made of a reasonable Size.

The Cariates, and the common *Columns,* should never be used together, under the same Entablature; for besides that, there can never be a just Symmetry between them; the *Figures* of Women as high as common *Columns* wou'd be Monstrous, and make all the rest of the Architecture appear mean and pitiful.

There are some Cariates that have their Arms cut off, as those, for instance, in the Hall of the *Swiss* Guards, in the old *Louvre.* But this kind of Mutilation, which is only used to make the *Figures* more light, and delicate, or rather, to make them more conformable to the other *Columns,* are only proper for Termini or Terms; which are a kind of half *Human Figures,* seeming to proceed out of a Vagina or Sheath.

The Cariates must always appear in Characters proper to the Places they are used in; those for Instance, which support the Crowning of a Throne, ought to be Symbols, or Representations of Heroic Virtues. Those that serve as *Columns* in a Place of Devotion; shou'd bear the Characters of Religion; and those again, in Halls, and Banquetting Rooms, carry the Marks of Gladness, and Rejoicings.

Tis not proper to use Cariates in the *Figures* of Angels, excepting at Baldequins, and Altars; and such as appear under that holy Form, ought, in my Opinion, to support the Entablature with their Hands, as bearing it easily, and without trouble.

The Entablature supported by Angels, may be *Corinthian,* and the Virtues *Ionic*; and both the one, and the other, somewhat less Massive than ordinary.

Of the *Persian Columns.*

These *Columns* are usually made in the Form of robust, or strong Men, with long Beards; and such Figures are very much fitter to represent an unhappy Slavery, than those of Women.

The Character of Slavery is express'd in the *Persian* Order, either by tying their Hands before, or behind their Backs.

Columns of this Kind, may be very properly used in a Cabinet or Gallery of Arms, or in Palaces, in which Case, they may be made Gigantic, and their Entablature *Doric.*

We wou'd not however insinuate, that the Figures of Men, are always Marks of Slavery, they are frequently used as Symbols of Virtues, and Vices; of Joy, Strength, Valour, and even of Fabulous Deities; as when they are made in the Figure of *Hercules* to signify Strength, of *Mars* to shew Valour, of *Mercury* to represent Dexterity, and of *Fawns,* or *Satyrs,* to inspire Mirth, and Jollity.

Of *Termini*, or *Terms*.

Termini, are another Kind of Symbolical Columns, in Human Figures, that appear with a half Body, as if they proceeded out of a Sheath, or Case.

To give them a Figure proper to represent a delicate Column, their Arms are lopp'd off, and their Body does not appear below their Girdle.

These *Termini*, are proper in Decorations of a Theatre, as also, in Pieces of Architecture, of the Crail'd-Work Kind.

Observations.

The *Termini* have this in common with the Cariates, that they shou'd never be brought to match with the common Columns: This Advantage, however, they have in particular, that a Man may give them what Degree of Delicacy he pleases, by lengthening out their Sheath, and raising the Figure to any Height described; by this means they will be made to suit gay, airy Architecture; such as Cabinets, Salons, and Arbours of crail'd Work.

'Tis not reasonable, in my Opinion, to reduce the Figures of Angels into *Termini*; tho' we see it has been formerly done in Places of Distinction.

Of *Arches*, or *Portico*'s, supported by *Columns*.

We have but few Instances of such Pieces of Buildings; tho' nothing hinders but they may be us'd, where the Architecture is not requir'd to be very strong; as in a plain open Gallery, serving for a Passage, or Communication between two Parts of an House; or when it is desired to have a slight Terras in the Front of a Building, and a Gallery, or Portico underneath.

In a Portico of this Kind, I wou'd have nothing but the Archivolte upon the Column; the Cornice shou'd be plac'd over the Archivolte.

Of the *Entablatures* that have *Breaks*, or that project *unequally*.

The *Entablature* is sometimes made to go back, or retreat a little between the Columns; but such breaks shou'd never be used, but on extraordinary Occasions, and for special Reasons, as where there are not large Stones sufficient to carry out the whole *Entablature* to its due Pitch; or where a great Projecture between the Columns might intercept the Light necessary underneath, or prevent the View of any thing above; as when an Attic Story, is adorned with a Basso Relievo, Trophies of War, *&c.* It must not, however, be forgot, that the principal End of the *Entablature*, is to shelter what is underneath; which in this Case, it only does by halves, as having nothing beside the bare Projecture of the Cornice for that Purpose.

Of the *Attic Order*.

This *Order* is a kind of rich Pedestal; some Architects, on some Occasions, give it the several Capitals of all the *Orders* of Columns; but the *Ionic*, *Roman*, and *Corinthian*, do not at all become it. The best way, in my Opinion, is only to distinguish the Capitals, and by a Difference in their Mouldings; which may be made more or less simple, or more or less delicate, according to the Relation they are to bear the Architecture underneath.

We also give the Name of *Attic* to the whole Story, wherein this *Order* enters; this little *Order* being always found over another that is greater.

This Pedestal, or false Pilaster, ought always to have the same Breadth with the Column, or Pilaster underneath, and its Height may be equal to $\frac{1}{3}$, or $\frac{1}{4}$ of the same Column, or Pilaster, by which it is supported.

SECTION IV.

Of the *Assemblage* of ORDERS.

Observations.

WHEN two Columns are placed over one another, they must be of different *Orders*; th Stronger always to support the Weaker; for Instance, the *Doric* may be placed over th *Tuscan*, the *Ionic* over the *Doric*, the *Composite* over the *Ionic*, and the *Corinthian* over the *Composite* or *Roman*.

II. The upper *Order* must always be less Massive, than the under, agreeable to the Maxim tha the Stronger, ought to support the Weaker.

III. Th

III. The Columns ought to ſtand exactly over each other, ſo that their two Axes may be both found in the ſame Perpendicular.

IV. The Diſtances between the lower Columns muſt be determined by the Intercolumniations of the *Order*, that is without Pedeſtals, and the Diſtances of the upper Columns by the Intercolumniations of the *Order* with Pedeſtals; taking Care by the Way, that the firſt *Order* be mounted on a pretty high Zocle, or an Aſcent of ſeveral Steps, to ſerve inſtead of a continued Pedeſtal, or Foot.

To the upper *Order*, I give a Pedeſtal, becauſe being confin'd to the Breadth of the Intercolumniation of the lower Order, its Columns, by this Means, are render'd ſmaller, inſomuch, that the Diameter of their Baſe does not exceed that of the Top of the under Columns; which is a Rule that ought not to be diſpenſed withal.

How to find the *Module* of an *Order* that is to be plac'd over another: It is here propos'd for Inſtance, to place the *Ionic Order* over the *Doric*. Plate XXIV.

Conſider firſt, that in the *Doric* Order without a Pedeſtal, Plate IV, the Columns are plac'd at the Diſtance of 5 Modules 35 Minutes from each other in Portico's. The *Ionic* Order with a Pedeſtal, muſt be 7 Modules 20 Minutes, to be rais'd over this *Doric*.

When two Portico's are plac'd over each other, the Higher ought to be regulated by the Lower; I mean the Width of the upper Arch ſhou'd be made equal to that of the Under; it being but juſt, that the two Arches ſhou'd have the ſame Width. On ſuch an Occaſion, one may make the Lower Arch 10 or 12 Minutes narrower than uſual, that the Width of the upper Arch may be the better proportioned.

The *Roman* or *Compoſite* Order, does not match perfectly well with the *Ionic*: Becauſe its Capital is higher, with regard to its Column, than the *Ionic* Capital, with regard to the *Ionic* Column; and becauſe the Denticles of the *Ionic* appearing ſomewhat weak underneath the Modillions of the *Compoſite*. However, the *Compoſite* being in this Place leſs than the *Ionic*, the Proportion between their Capitals becomes leſs ſenſible, as well as that between the Denticles of the one and Modillions of the other.

One finds a Difficulty in placing three Orders over each other; and it conſiſts in this, that the ſecond Order having a Pedeſtal, the Columns of the Third become a little too big at bottom; tho' it is ſo very little, that the Eye can hardly perceive it. This Inconvenience, however, may be remedied, by taking the Exceſs imperceptably away, wholly from the Baſe of the Column: It is true, this will occaſion a little Swelling, but that will not do any harm.

Of *Pilaſters* rais'd over one another. Plate XXVII.

As *Pilaſters* are of the ſame Bigneſs from Top to Bottom, one wou'd imagine at firſt Sight, that to preſerve a Regularity, the *Pilaſters* plac'd one over another, ſhou'd be of the ſame Bigneſs; but there are two Reaſons which oblige us to recede from this Rule.

The Firſt is, that if the Module were to continue the ſame in the upper and lower *Pilaſters*, the Conſequence wou'd be, that the Orders and Stories wou'd increaſe in Height, in Proportion as they riſe over one another, which wou'd be prepoſterous.

The ſecond Reaſon is, that if there ſhou'd be Columns along with the *Pilaſters* of the lower Order, the Diameter of the upper *Pilaſters* wou'd be bigger than the upper Part of the Column underneath, which wou'd be another Fault.

One ſhould never therefore, place two *Pilaſters* of the ſame Bigneſs over one another, unleſs the upper be *Attic*.

Remarks.

In the Aſſemblage of *Pilaſters*, all that is requir'd by moſt Architects is, to examine how big the Baſe of the upper *Pilaſter* may be with regard to the Top of the under: For the *Pilaſters* being always equally big at the Top and Bottom, it follows inevitably, according to the foregoing Rules, that by obſerving the ſame Number of Modillions in the two Orders, the upper *Pilaſter* always becomes leſs than the under, as in effect it ſhould.

Pilaſters ſplit or cloven from Top to Bottom in an inner Angle, never have a good Effect; for beſides, that their Halves have no Symmetry with the entire *Pilaſters* that anſwer to them, their Capitals do likewiſe become very defective.

Obſervations.

When Columns and Pilaſters are plac'd under the ſame Entablature, the Entablature muſt be that of the Columns.

When Columns and Pilaſters are plac'd under the ſame Entablature, they ſhould never, if poſſible, ſtand in the Front-line by Reaſon of the manifeſt Irregularities that would follow thereupon; they muſt therefore be ſeparated by a Reſſaut or Difference in the Range.

A Reſſaut can never conſiſt of leſs than an entire Modillion, if the Order be either *Compoſite* or *Corinthian*, without ruining the Regularity of the Parts of the Soffit of the Cornice.

Further,

Further, if the Reffaut does not exceed a Modillion, the Column will remain engag'd in the Body of the Building.

When this Column is allow'd to be thus engag'd in the Body of the Building, it muft have a *Pilafter* by its Side, to make a Symmetry with that on the other Side the Window, which the Column cou'd not well do: Befides, that without this *Pilafter*, the Angle of the Building wou'd be too weak.

But if one would have the Column entirely difengaged from the Building, the Reffaut or Difference of Range in that Cafe, muft confift of feveral Modillions; and behind the Column muft be a *Pilafter*, befides that which makes the neceffary Symmetry with the Window.

When *Pilafters* accompany infulate Columns, and ferve as a ground or arrier Corps, they ought to be at a competent Diftance from each other, to prevent their Capitals from interfering, which is a confiderable Fault we find frequently committed, but which however, ought to be carefully avoided.

Where *Pilafters* are plac'd under an Entablature of Columns, by way of ground or arrier Corps, as was juft now fuppofed, there arifes a confiderable Difficulty, and it is this.

I have already fhew'd that in the Orders of *Pilafters*, the Modillions of Neceffity muft be farther apart than in the Orders of Columns by means of the equality of the Diameters of the Shaft above and below.

Now fuppofe this Excefs to be of 4 Minutes; here then are 4 Minutes to be regained on the Breadth of the *Pilafters*, and on that of the Modillions and Inter-modillions, in order to adjuft the *Pilafters* to the Columns; but the *Pilafters* behind the Columns muft be excepted out of the Diminution, becaufe being very near the Columns, neither their Bafes nor Shafts can lofe any thing of their Breadth without its being perceived, fo the whole Reduction will lie on the *Pilafters*, which are by the Side of each other.

Firft then the *Pilafters* which are far afunder, may be each two Minutes lefs in Breadth without being difcover'd, in regard the Eye cannot compare thofe at one Glance, with thofe behind the Columns; but this Diminution being no more than 1 Minute on each Side, there will ftill remain two to be gained out of the Modillions. The Modillions therefore muft be made a little broader than thofe in the Entablature of Columns, and the Inter-modillions the fame; and if with this, the Strength of the Modillions be likewife a little increafed, we fhall have perfect Squares in the Larmier to feperate them from each other; and by this Means the Order of *Pilafters* will be brought to agree with that of the Columns; for as I faid before, the Flatnefs of the *Pilafters* will make them appear broader than they really are, in regard to the Colomns, which will render the above Diminution of the *Pilafters* imperceptable; and will feemingly agree better with the Columns being thus diminifh'd.

When a *Pilafter* is placed behind a Column, the Breadth of the upper Part of its Capital fhould be reduc'd to that of the upper Part of the Capital of the Column; to the End, that their Bafes being of the fame Breadth, their Abacus and Volutas may be fo too.

SECTION V.

Of *Gates* or *Doors*, *Windows*, *Pediments* and *Niches*.

GATES or *Doors* are either large, moderate, or little. The Large ought to be arched to an entire Semi-circle; the Moderate may either have a Semi-circle or fomewhat lefs; and the little Ones muft be fquare, excepting they ferve for fubterraneous Paffages, which being ufually vaulted, their *Doors* muft be arched likewife.

All regular *Gates* have three principal Parts, thofe with Arches have Pedroits or Jaumbs, Impofts, and Archivoltes, the fquare Ones have a Chambranle or Door-cafe, Frize, and a Cornice.

Each kind of *Door* is fometimes accompanied with an Order of Columns or Pilafters.

When they are fo accompanied, they are ufually crowned with a *Pediment*, and fometimes alfo with a *Balcony*.

Square *Gates*, without any Order of Columns or Pilafters, have their Cornices frequently fupported by Confoles, particularly, where thefe Cornices have a little Projecture for a Shelter to Perfons underneath them.

Of

Of the Proportion of *Gates.*

The ordinary Proportion of *Gates* is to have their Height double to their Width; this Rule, however, is not so inviolable, but that they may have a little more, or a little less, on Occasion.

Remarks.

Gates are called *Tuscan*, *Doric*, *Ionic*, &c. according to the Relation which their Imposts, Cornices, and Chambranles bear to the Parts and Mouldings of those Orders.

Besides *Gates* in the regular Architecture, there are others of the *Rustic* Order; which in their Kind have very singular Beauties, and such as, in some Places, are more suitable than any others that would be used; particularly, in the Entries of great Houses, where the Front has no regular Order of Architecture.

Coach *Gates* and others of a middle Kind are usually made with two Leaves or Folding-doors; and when they are a little bigger than ordinary, have a Dormant (*i. e.* the upper Part of the *Gate* that does not open) which Dormant, when the *Gate* is arched, commences from the Spring of the Arch.

In one of the folding Doors is usually a Wicket, or little *Gate*, thro' which People on foot ordinarily pass.

Gates of Parks, Gardens, *&c.* have usually a Kind of Pillars behind, called Buttresses or counter Forts; these Pillars should reach far enough inwards to receive and stay the Leaves or folding Doors, as also to support the Stones, or Barriers plac'd there for their Security.

It may be easily concluded, that these Buttresses are only us'd in such *Gates*, as have no Lodgment to sustain them.

These kind of *Gates* may also have Buttresses on their Sides with Consoles, both to support the Architecture of the *Gate*, and also to add a Grace and Ornament to it, especially if the Wall be low, and the *Gate* be high and magnificent.

A Console, in my Opinion, shou'd always have something exceeding massive to sustain and serve it as a Rest when raised.

This Sweep, with the Archivolte of any great publick *Gate*, as that of a Place Royal may be supported by *Pilasters*, which will make a Symmetry with the ground Story; and may consist of Columns supporting a Terrass or Balcony, to be continued quite round the Place.

Large *Gates* which are never to be shut, and are principally intended to shew the Magnificence of Princes and People, ought to have a noble and rich Composition, with great Streets answering to them, in a peculiar Manner, have their Appearances enobled by large Avenues, which shew them at a great Distance.

The Vaults or Ceilings of these *Gates* shou'd be enriched with Compartments of beautiful Sculpture to make the Passage thro' them the more pleasing.

The Avenue on the Side of the Champaine, shou'd always consist of large Trees planted in parallel Lines, with an Interval equal to the Breadth of the triumphal Arch, that the Beauty and Magnificence of the Edifice may strike the Eye at once, and from a great Distance.

When a little Door is made in the Front of an ordinary but regular Building, it should be raised to the just Height of the Windows that accompany it, but its Breadth must a little exceed that of the Windows, lest while it is adjusted to the Rest of the Building, it appears ill proportioned.

If it is desired to have the Door adorn'd with an Order of Columns or Pilasters, it must be raised higher.

Of *Windows.*

Windows as well as *Gates*, differ both in their Bigness, and in their Architecture. The Biggest are seen in Churches, and are usually arched to a Semi-circle.

The moderate Ones frequently terminate in an Arch less than a Semi-circle. As to the small Ones, they are usually long Squares, their Height being sometimes double to their Width or very near so.

Observations.

In a Facade or Front of a Building, the *Windows* should be exactly perpendicular under one another, and to that End, Care must be taken, that they be all of the same Width, but in different Stories, their Height must be different.

Those of the lowest and uppermost Stories, may be less in Height, as well as less adorned, than those of the Middle; which are usually for the master Story.

The Width of the *Windows*, with regard to that of their Jaumbs, that is, with regard to the Breadth of the Wall between two *Windows*, may be as three to four, in temperate Climates like ours: as three to five in hotter or colder Climates, as three to six in Countries still more expos'd to violent Heat, or violent Cold; but the various Situations of a Building with regard to *East* and *West*,

or *North* and *South*, will always occasion a Variation in the Proportion of the *Windows* themselves. See VITRUVIUS on the Subject.

Large *Windows* shou'd have a Cornice that projects pretty much, to be a Shelter to those who present themselves at it, and in that Case, the Projecture should be supported by two Consoles, as well as the Rest or leaning Place that terminates the *Window* at bottom.

The Consoles of the Cornice shou'd be as big at Bottom as at Top, that they may fall in regularly with the Jaumb and Chambranle.

The Breadth of the Chambranle may be one sixth of the *Window*.

Without the Chambranle is a plat Band, serving it as an arrier Corps, called a *Montant* or *Window-post*, which may have an equal Breadth with the Chambranle, or on Occasion a little less. It serves particularly to place the Consoles of the Cornice thereupon.

If the Cornice be not supported by Consoles, this plat Band shou'd be then narrower by one Half, and without any Mouldings besides those that compose its Cornice.

The Consoles that support the Rest, or Bottom of the *Window*, shou'd be placed underneath the Chambranle, and be equal to its Breadth, and their Wreathings be made to run out on the Sides.

The Height of those Consoles must not exceed half that of the opening of the *Window* at most, nor fall short of $\frac{1}{3}$ of that opening, when the least.

They are sometimes made narrower at Bottom than at Top, but in my Opinion, it were better to have them equally big at Top and Bottom.

The Top of the Perron or Ascent frequently terminates the Bottom of the Consoles.

The best Proportion for the Height of *Doors* and *Windows*, is double their Breadth; tho' some will allow 2 $\frac{1}{2}$ Diameters, and even 3, which must have a very disagreeable Effect.

In Buildings of Note, where the Second is the principal Story, the *Windows* there may be $\frac{1}{10}$ or $\frac{1}{12}$ higher than those in the lower Story; those in the Third $\frac{9}{12}$ of those in the Second; and those in the Attic Story $\frac{3}{4}$ of the Height of the *Windows* next under them. Tho' some will have them but one Half; in which Case I think they are fitter to fill the Place of Port-holes in a Ship, than to illuminate extensive Rooms in any magnificent Building.

Venetian Windows are graceful Ornaments to a Building, provided that the Architect hath judgment enough to know, when to admit, or when to reject them; but it frequently happens, thro' the Ignorance of the Architect, that, thinking to add a Grace to the Building with those Ornaments, he adds a hideous Deformity thereto. For,

First, in order to give them their proper Grace, the Peers on both Sides thereof, should be of equal Breadth, tho' we see Instances to the Contrary in Buildings of Note; where one may see a *Venetian Window* sculk in a Corner with a Pier 9 Inches broad on one Side, and a Pier 6 or seven Feet broad on the other Side; in which Case a plain or common Window wou'd be more graceful, for a Piece of Drapery ill plac'd, is much better left out than put in.

Secondly, when a *Venetian Window* is erected over a *Venetian* Door, all their Peers and Openings in their Breadth, shou'd correspond with each other, tho' we see Instances to the Contrary in some considerable Buildings, where one sees a very small *Venetian Window* over a large *Venetian Door*, where, neither the Piers or Opens correspond with each other, which is quite repugnant to the general Precept follow'd by all judicious Architects, *viz*. Vacuities ought to be over Vacuities, aud Solids over Solids; which useful Maxim is forgot in this Composition.

Thirdly, the Soffitas of the Side-opens of the *Venetian Window* ought to be horizontally level with those of the *Windows* on one or both Sides thereof; which is a Rule not to be dipensed withal; tho' very ill practis'd, by those only, who have but little Skill or Judgment in Architecture.

Some, thro' a blind Custom, make the *Window* Stools to project 3 or 4 Inches without Side the Die of the Wall, tho' they have neither Architrave, Console, Column or Pilaster to support; which Projection is neither useful or ornamental; but on the contrary, hurtful and disagreeable; for, the broader the upper Beds of them are, the greater Power the Winds have of dashing the Water against the *Windows*; besides, the Water drilling down from them, by means of this Projection, stains the Wall.

Some *Windows* are call'd Lutherns or Dormers, such as are raised over the Cornice of the Building, or in the Roof of a House.

Lutherns shou'd be built on the Wall, and stand very upright. Being us'd with some in Houses of indifferent Architecture, 'tis become a Custom to cut off that Part of the Cornice directly underneath them, that it may not intercept the View of what passes below, but this shou'd never be practis'd in any Building of magnificence; such Notches in the Cornice having a very ill Effect outwards, which ought to be carefully avoided, tho' to the Prejudice of those People who may chance to possess these upper Stories.

Of

Of the several *Stories* in the Height of a Building, of the same *Order* of Columns or Pilasters, Plate LVI. and LXXXII. Lib. V.

In a publick Place, intended for the Magnificence, as well as the convenience of a City; the Buildings cannot be too Stately: Now, as nothing carries more State with it, than one grand *Order*, this is what must be thought on in the first Place, however, as Conveniency on this Occasion is to be inseparable from Magnificence, I think two *Stories* may be allowed in the Height of this one *Order*; And if the whole be raised on a Rustic *Order*, it will be a great Addition to the Beauty of the Ordonnance.

Over this grand *Order*, one may raise a Ballustrade, to make it terminate the more agreeably, and, to conceal, in some Measure, the Roof, which is never found any great Ornament to a beautiful Building.

Instead of Pilasters, one might place an *Order* of Insulate Columns, with a Corridor, or Gallery behind, which wou'd be still infinitely better. See Plate LXII. Lib. V.

Of *Pediments*. Plate XXIX.

By *Pediment*, we mean the Crowning frequently seen over Gates, Doors, Windows, and Niches; and sometimes over entire *Orders* of Architecture. The Ridges of ordinary Houses, were what gave Architects the first Idea of this noble Part.

The Parts of the *Pediment*, are the *Tympanum*, and its *Cornice*, See Plate XXIX.

By *Tympanum*, we mean the Area or Space included between the *Cornice* which Crowns it, and the Entablature, which supports and serves it as a Foundation.

The *Tympanum* is either triangular, or circular; the Triangular, the Workmen call pointed, the Circular they call arched.

The Naked of the *Pediment* i. e. the *Tympanum* A, which is in the same Perpendicular with the Frize B.

The Modillions of the *Cornice* of the *Pediment*, ought to be found in the same Perpendicular with those of the underneath.

That Part of the *Cornice*, whereon the *Pediment* stands, shou'd not have any Cymatium, in regard the Cymatium of the rest of the Entablature, when it meets the *Pediment*, passes over it; but this change of Determination, occasions a very considerable Difficulty, and it is this.

If the Cymatium were carried over the *Pediment*, beginning just at the Angle of the *Cornice*, as one wou'd imagine it shou'd do, it wou'd be considerably widened, as that Angle is acute. But this wou'd be a considerable Eye-Sore, both on account of the Inequality of its Width, and because it wou'd be rendered too strong, and heavy for the Corona.

Some Architects, to reduce this Cymatium to a proper Width, make the horizontal Cymatium, that supports the two Sides of the *Pediment* very flat; but this is to prevent one Deformity, by putting another in its Stead.

Other Architects make a little Retreat, or Elbow, as the Workmen call it, at the Extremity of the Cymatium of the *Pediment*; and this Expedient, in my Opinion, is preferable to any of the rest, See Plate VIII. Lib. IV.

It here appears very evidently, that if the Cymatium A B, were to pass over the *Pediment*, commencing from the Point B, it wou'd have the whole Breadth C F, whereas by commencing from the Crossette, or Elbow D, it has only the Breadth E F, which is the just Breadth the Cymatium shou'd have according to my Rules.

Sometimes the *Pediment* does not commence from the Extremity of the Cornice; but in that Case too, there are Difficulties which we shall take care to examine hereafter.

Vitruvius observes that the Ancients did not approve of the Modillions in the *Cornice* of a *Pediment*; and the Reason they gave for it was, that Modillions being only intended to represent the Ends of Rafters, it wou'd be absurd to use them in the Declivity of a *Pediment*, where no Rafters are supposed to be. But the Truth is, these Modillions are rather Ornaments to sustain the great Projecture of the Larmier, than to represent the Ends of any Rafters, or other Pieces of Wood; and therefore it wou'd be a Weakness to be influenc'd by such imaginary Reasons; the rather because these Ornaments have a very good Effect, and especially when used in large *Pediments*.

A triangular *Pediment* may serve to crown three Arches, but a circular *Pediment* can properly crown but one Arch.

I wou'd not have more than two *Pediments* placed over each other, in the same Front of a Building; and even where there are two, it were best to have one of them Circular, and the other Triangular, the last finishing the Front, in the Manner of a Ridge.

We now use none of these broken *Pediments*, especially without Doors, where they are exposed to the Weather, which Michael Angelo introduced in his Time: Nor is there any Body that seems to value them, that has either Taste, or Experience.

Though

Though the *Pediment* is bounded by its *Tympanum*, and its *Cornice*, yet, were it not for its Entablature underneath, it wou'd not only be ill supported, but imperfect too; just as a Ridge of a House wou'd be, if the Rafters that compose it, wanted Beams, to prevent their flying asunder.

Of *Niches*.

Niches are hollows sunk into the Wall, for the Commodious and Agreeable placing of Statues.

Their ordinary Proportion is to have two Circles in their Height, and one in their Width; but one may make their Height something more; the Excess being to compensate for the Height of the Plinth, or Pedestal of the Statue.

The Hollow is a Semi-circle at Bottom, at Top it terminates in a kind of Canopy.

Niches have frequently an Impost, and an Archivolte, or Head-band, and their Canopy wrought and enriched in manner of a Shell.

The Breadth of the Archivolte may be made equal to a Sixth or Seventh Part of the Aperture of the *Niche*, and the Height of the Impost $\frac{1}{5}$ or $\frac{1}{6}$ of the same.

The Imposts, and Archivolte ought to consist of such Ornaments, and Mouldings, as have Relation to the Architecture of the Place.

When a *Nich* is placed underneath an Impost between two Columns, or Pilasters, it shou'd have no Imposts of its own; for two Imposts over each other, wou'd have a woful Effect; besides, that the Pedestals, in this Case, having their Bases, and *Cornices*, there wou'd be too many Mouldings over one another.

There must no *Niche* be made between two Pilasters, if they be not apart nearly $\frac{1}{3}$ of their Height, otherwise we shou'd have *Niches* too scanty, and narrow.

Care must also be taken, that they be not too Big, lest by that means the Architecture be made to appear too little or pitiful: Thus, from the Largeness, for Instance, of the *Niche*, one is led to judge, that the Architecture is only intended either for a Chappel, or other Building of an ordinary Size.

Niches ought to be placed at the Height of the Pedestals of the Columns or Pilasters that accompany them.

When *Niches* are placed underneath Imposts, the opening of the Arches shou'd be somewhat narrower than ordinary; that the Impost being on that Account a little higher, the *Niches* may become of a more moderate Size, or Bigness: For this Reason, instead of 12 Modillions between the Pilasters, I only here have 11, that is, I retrench one Modillion from the Cornice, that the Pilasters may approach each other equally.

When the Columns have no Pedestals, a *Niche* may be raised higher than their Base; and in that Case, a Table, or Pannel, may be placed underneath.

If it happens that a *Niche* with an Impost, be placed between two Pilasters, without any Portico, it shou'd be made with a Retreat, or Fall-back, to prevent the Necessity of continuing its Impost between the Pilasters; for the Impost being proportioned to the *Niche*, cannot be in proportion to the Pilasters. Besides, without this Expedient, I don't readily see how it cou'd be well terminated on the Side of the Gate.

We see sometimes square *Niches*, but they want all the Beauty of the others.

If the *Order* of Columns, or Pilasters, shou'd be very big, and very high, the *Niche* wou'd become too large, and unsizeable, the Pilasters must be brought a Modillion or two nearer each other; and instead of a *Niche* with a Retreat, one may make a *Niche* with a Chambranle, and a Cornice, crown'd with a Pediment, over which may be an Oval Light, of the same Width with the *Niche*.

Of *Statues*.

A Figure, or Statue, rais'd over an *Order*, or Building, in its Height, may be equal to $\frac{1}{3}$ of the Column, or to $\frac{4}{9}$ thereof, if the *Statue* hath no Niche. If it be Bigger, it will make the Building appear little; and if it be less, for Instance, $\frac{1}{4}$ or a little more, the Building will appear by much the larger.

Of the Size of the *Statues*.

'Tis observable, that in Proportion as a Statue is raised above the Eye, it appears to diminish in Bulk, until such Time as being elevated to a very great Pitch, it becomes almost imperceptible; for this Reason, some Architects do contend, that the Sculptor must always accommodate his Figures to their Height, and encrease their Bigness just as the Elevation increases, to the End that they may always appear of a reasonable Size. But as the *Order* of Columns, are to be distinguished in proportion as they rise over one another, it wou'd happen that the Statue in this Case, wou'd become too big for the *Order*. There needs not therefore, be any Difficulty made with regard to what the Architect is to do on this Occasion: He must always proportion his Figures to the *Orders*, and the Stories where they are to be placed; unless it happens in a close, narrow Place, as in a Stair Case, or Dome, in that Case, the *Orders*, and the *Statues* may be enlarged in Proportion. However, care must be taken not to run into Excess, it being better they shou'd appear too little, than too big.

Instead of placing *Statues* to finish the uppermost Stories, one may have Vases, Torches, Pots of Incense, Trophies, and the like Ornaments; which will suit better with such Places, than Human Figures; unless those represent the tutelary Angels, appointed for the Guard and Protection of the Building.

Figures placed in Niches, shou'd have their Eyes at the Height of the Centre of the Sweep, as in the Diameter of an Arch.

'Tis usual to add little Plinths, or Zocles for Bases to these Figures: But when the Niches are of the biggest, so as the Figures wou'd appear too Gigantic, if having their Eyes in the Centre of the Sweep, they shou'd reach to the Bottom, abating the Height of a little Plinth under their Feet, in that Case, they may be raised on a moderate Pedestal, but on the other Hand, care must be taken, that these Pedestals be not too high, and the Figures too little with regard to the Niche, it being a great Eye-sore, to see a little Figure in a big Niche. On such an Occasion, I imagine the Pedestal may have $\frac{1}{5}$ of the Height of the Figure; if it had more, the Figure wou'd be too little.

When Figures are placed in Niches, by way of Ornaments to the Portal, or Frontispiece, there seems no Necessity to have any above the Entablature; but in their stead, one may have Vases, or other Ornaments, which will nearly have the same Effect, for those Figures in Niches being frequently required to be bigger than those placed over the Entablature, such an Inequality of Figures in the same Frontispiece, might be displeasing to some People.

Of *Pyramids.*

Pyramids are a kind of Monuments proper for transmitting the Memory of great Princes to Posterity, they may be adorned with Trophies of War, with the Statues, and Basso Relievo's, to represent their Memorable Actions, their Victories, Virtues, Power, and the Enemies they subdued.

A *Pyramid* cannot be bettter situate, than in the Middle of a large Place or Square, where it may be seen on all Sides, and at different Heights, without Interruption.

It shou'd be raised to such a Height, as may set it above all the Buildings that compass it, so as it may be viewed out of the Country, and be a noble Ornament to the City where it is raised.

The *Pyramid* is always Esteemed a Symbol of the Glory of Princes; for which Reason, it must be made so much the more Magnificent, as the Prince, for whom it is designed, has been more eminent, for Virtue, and Power.

Further, a *Pyramid* should always be single, or alone, otherwise it loses its proper Signification; which is to represent the Glory of the Prince who reigns, or reigned.

SECTION VI.

Of *Ballusters*, and *Ballustrades*, *Balconies*, *Perrons*, or *Ascents.*

BALLUSTERS are a Kind of little Pillars, joined by a Rail, a convenient Height for the Elbows to rest upon; of these I propose various Forms, accommodated to the different *Orders* of Architecture, where *Ballustrades* may be used. See Plate XXXI.

By *Ballustrade* we mean a Series, or Row of *Ballusters*, with their Rail serving as a Tablette, or Rest to the Elbows, and at the same Time a Fence, or Inclosure to Altars, *Balconies*, Terrasses, Water Works, Stair-Cases, and large Windows.

Ballustrades consist of one or more Ranges or Rows of *Ballusters*, terminated by Pedestals of the same Height.

If in a Stone, or Marble *Ballustrade*, the Distance from one Pedestal to another be too great for a Tablette, or Rail of a single Stone, it must be made of two; in which Case, it will be proper to have the Juncture or Assemblage supported by a Die, if a *Balluster* be judged too weak to support them.

The Ranges, in my Opinion, ought to terminate in half *Ballusters* joined to the Pedestals; though there are other Architects of another Sentiment. However, every Man may follow his own Fancy, I here have given Instances of each Kind.

We have *Ballusters* of various Figures, but the Round, aud the Square, shou'd always have the Preference.

Every *Ballustrade* shou'd have a Zocle. PALLADIO, indeed, gives us an Instance to the contrary, in his *Egyptian* Hall. Page 110, but this is not to be imitated.

Round *Ballusters* are not so heavy as the Square ones, they are frequently of very hard Stone, as that of *Lyons*, which works better than any other Kind, except Marble.

When it is desired to have a *Ballustrade* richer and more delicate than ordinary, such as we sometimes see before Altars, it may be cast of Brass, or Silver, unless to save Expences, it be thought better to have it of Wood gilded; for such Kind of *Ballustrades* may be made as rich in Ornaments, as one pleases: Several Designs of this Kind will be found in Plate XXX. And those who have a Taste for such Things, will find no Difficulty in composing infinite others.

All *Ballustrades* being intended to be Breast high only, shou'd never exceed three Feet and an half, nor come short of two Feet and a quarter, when they are only intended as a Rest, and Inclosure, before an Altar, or Gallery, &c.

Observations.

In *Ballustrades* of Stair-Cases, the Zocle shou'd always be the Height of the Steps, and the *Ballustrade* terminates with a Pedestal on the Ground, as B, much better than with a Pedestal on the Descent, as A. Plate XXXI.

Whether the Pedestal be on the Ground, or on the Descent, it ought to have a Buttress in Manner of a Console, to sustain and bear up against the Pressure of the *Ballustrade*.

In *Ballustrades* that are between Pedestals without either Bases, orCornices, of which I give Instances, the Tablette shou'd only consist of a Plat-band, sustained by a Fillet, or little Talon underneath, and the Zocle may have a little Cavetto over it.

When a *Ballustrade* is independant, one may proportion its Pedestals to its *Ballusters*, but when it is used in *Orders* of Columns, whereon it has some Dependance, the Pedestals in that Case, cannot be managed at Pleasure.

If the Pedestals that terminate a *Ballustrade* be compleat and well proportioned to the Pillars which they support, their Cornices will be found too weak to be continued alone, and so to serve for a Tablette to the *Ballustrade*, it will be necessary therefore, to add a Plat-band underneath, which will make a Symmetry with that round the Table, or Pannel of the Pedestal.

Instead of *Ballusters*, we sometimes make Entrelas of crailed Work, which are not inferior to the others in Beauty. See Plate XXX.

One might enrich these, yet further, by making the Wreaths, Roses, and Foliages of Brass, which wou'd do still infinitely better if they were gilded.

These Entrelas shou'd be made more or less Delicate, according to the Places where they are used. For Instance, those that are to be placed at Top of a Building, and which can only be viewed from afar, shou'd be less delicate, than those that are to be viewed near at hand,

Of *Balconies*.

A *Balcony*, is a little slight Terrass, standing out from a Body, or naked of a Building, where one may take the Air, and easily observe what passes underneath.

Its Parts are the Terrass, the *Ballustrade* that incloses it, and the Consoles that support it; or, to explain the Thing more accurately, a *Balcony* is a Piece of Architecture raised in the Air, inclosed with a *Ballustrade*, and supported by a little Entablature, whereof the Cornice, or uppermost Part makes a Terrass; the Frize, and Architrave being only continued at the Bottom, and Sides, and the whole Balcony further supported by Consoles.

The Height of the Consoles, may be equal to their Projecture, but it will be an Addition both to the Beauty, and Strength of the Work, if they be made higher.

A *Balcony* may be continued quite through the Front of a Building, by adding Consoles from Space, to Space, to be disposed between the Windows which will be underneath.

Balconies of Iron, will do better than those of Stones, as being Lighter, and less Subject to Decay; if they be gilded, they will be exceedingly Magnificent, and a very proper Ornament for a Palace.

Of *Perrons*, or *Ascents*.

By *Perron*, or *Ascent*, we mean an Elevation given to the Entrance of a Building; the Portal, or Frontispiece of a Church, Palace, or any other great Building, shou'd always have a rise of some Steps, that is, in a Word, it ought to have a *Perron*.

The Rest, or landing Place of a *Perron*, shou'd be always extended in Width, as far as the Frontispiece, if possible; and the Steps, according to Vitruvius, must ever be an odd Number. These Steps shou'd always be 5, or 6 Inches high, and 10, or 12 in Breadth, that is, their Breadth must be double their Height; which is found to be the best Proportion, to have an easy, and commodious *Ascent*.

Where the *Perron* is 13, or 15 Steps high, it is necessary, at least it is convenient, to interrupt its Range with one or two landing Places, that there may not be too many Steps to mount successively, and that the Eye may not be displeased in Descending so great a Height without Rests.

A *Perron* shou'd always be confined to the Height of the Zocle or Foot of the whole Building.

Tho'

Tho' this Zocle or Foot ſerves as a continued Pedeſtal; yet muſt have neither Baſe nor Cornice, when its Height is taken up by a *Perron*; and I can't at all agree with PALLADIO in the Examples he has given us to the contrary.

Sometimes the Place does not allow a *Perron* to be extended ſo far as one would otherwiſe wiſh, in which Caſe, it muſt be reduced as conveniently as may be to the little Space alloted to it.

Some particular *Remarks* and *Obſervations.*

When it is required to have an Order of Columns or Pilaſters placed in a ſecond Story; the firſt Story may be Ruſtic, and its Arches in Boſſage, which will not only add to its Solidity and Strength but to its graceful Appearance.

If the firſt Story be Ruſtic, the Order of Columns or Pilaſters raiſed over it may be made higher, that is, its Height may exceed that of the Ruſtic Order; which in this Caſe only ſerves it as a Stand or Foot.

When the Body of a Building is to be raiſed higher than the Alæ or Wings that accompany it, 'tis not neceſſary for that Purpoſe, that the firſt or loweſt Order of the Body ſhould be taller than that of the Wings, but that of the Wings may be continued throughout, and the Elevation of the main Body above theſe may be left to a ſecond Order, and even, if it be neceſſary to a Third.

For the third Story one may uſe an Attic Order.

We have already obſerv'd, that on ſome Occaſions, one may make two Stories in the Height of the ſame Order. One may likewiſe make two Stories in the Height of the ſame Order of Pilaſters, by placing the Maſter-ſtory a-top, that of the Offices and Domeſtics underneath, but this laſt with ſimple unadorned Windows; and yet the whole be conducted in a noble and graceful Manner.

In ſuch kind of Ordonnances I would never chuſe to continue any Mouldings quite to the Pilaſters, except the Zocle of the whole Building.

The Body of the Building may be of Brick, where this is in uſe; and the Architecture, or Orders of a beautiful white Stone, which will make the moſt agreeable Facade of a Building imaginable.

Of the Diſtribution of *Ornaments* on the grand Parts. Plate XXVIII.

The *Ornaments* ſhou'd be diſtributed in ſuch Manner, as that they may always be ſuſtained by ſimple uniform Parts, to ſerve as Foils to ſet them off. I mean the Parts that are ſimple and plain ſhould always be ſo diſpos'd, as to be a Reſt or Repoſe to the Parts that are adorned. For Inſtance, if the Vault of a Church be full of *Ornaments*, the principal projecting Arches ſhould be plain; if the Vault be plain, the Arches muſt be enriched, with this Reſtriction, that the Compoſition of the Place, be ſuch as that *Ornaments* be ſuitable.

If it is deſired to have a great deal of Richneſs, and *Ornaments*. I mean, if the Place happens to require *Ornrments* both in the projecting Arches, and in the Compartments incloſ'd between them; it will be neceſſary, however, that the Arches and Compartments of the Vaults be bordered with pretty broad but plain Liſts, in order to make a Separation, and to prevent thoſe Parts from being blended and confounded together.

Obſervations.

When the projecting Arches of a Vault have no *Ornaments*, the Columns or Pilaſters that ſupport them, ſhould have no Flutings, (as Fig. A. Plate XXVIII.) and if the Columns or Pilaſters be fluted, the Arches ſhould be enriched, as alſo the Frize of the Entablature, (as Fig. B.) at leaſt this is my Opinion.

It may be obſerv'd, that the Zocle A B, which is here over the Entablature, cannot be ſeen from below, yet is it of ſome Uſe, to have the whole Sweep of the vaulted Roof in Sight; Part whereof, without ſuch a Riſe, wou'd be hid behind the Projecture of the Cornice; which would be a conſiderable Defect: The great Beauty of the Vault of a Church, and that whereon its Effect principally depends, conſiſting in its appearing rais'd as much as poſſible with a full Sweep.

Each Pilaſter in the Vault of a Church ſhou'd have a projecting Arch anſwering thereto, which Arch ſhou'd be of the ſame Breadth, and the ſame Projecture or Thickneſs with the Pilaſter that ſuſtains it.

In a Lodgment or Piece of Building that receives the Light under a Portico, and whoſe Windows have a Reſt or Support for the Breaſt, the Columns or Pilaſters ſhou'd have Pedeſtals of the ſame Height with thoſe Reſts, or to ſpeak more properly, thoſe Pedeſtals ſhou'd be continued ſo as to form Reſts or leaning Places for the Windows; otherwiſe the Columns and Pilaſters ſhou'd have no Connexion with the Pedeſtals.

If

If the Windows have no Refts, but reach down to the Pavement, the Columns and Pilafters will do much better without Pedeftals, than with them.

It may here be obferved, that an Order of Columns or Pilafters, which only takes up one Story in Height, makes but a mean Piece of Architecture, when the Windows are of a Bignefs fuitable to the Apartments.

An Order of Pilafters ufed in an Apartment fhou'd have a continued Pedeftal equal in the Height of the Windows; the Cornice of which Pedeftal fhould be flat, and have no Larmier.

In fuch Places where the Pedeftals are required to be higher, as in Churches, large Salons, Halls, &c. they muft be at leaft fix or feven Feet high, that their Cornice may not ftand directly out againft the Eyes of thofe who may have Occafion to come near.

A Pedeftal raifed above the Eye, muft never have a flat Cornice that is to be viewed from below, fhou'd always be adorned with a Larmier, which on fuch an Occafion, makes its chief Beauty, where as it only ferves to weaken and fpoil the Effect of the Cornice, where that Cornice can only be view'd from above.

Coupled Columns fhou'd ordinarily have but one and the fame Pedeftal, and the principal Reafon is, that thefe Columns requiring to be as near one another as poffible, it frequently happens they can't be fo well diftinguifhed from each other, but that their Bafes and Cornices will be confounded together, which muft needs have a miferable Effect, that by all means, ought to be avoided. To which it may likewife be added, that the two Pedeftals being brought into one, the Columns will be more firmly fix'd.

If it fhou'd happen, however, that two coupled Columns be found far enough a-part, to prevent any Confufion of the Cornices or Bafes of their Pedeftals, each Column may have its feparate Pedeftal; and this on fome Occafions, is neceffary; as for Inftance, when two Columns are raifed upon two others; for in that Cafe it is Prudence to make the Pedeftals as light as poffible, and yet they will compofe a Kind of a continued Pedeftal by Means of a Rail or Balluftrade which connects them together.

It may be obferved, that I here only fpeak of Pedeftals that are compleat, for when two Columns have only a Zocle for a Pedeftal, it will always be beft to have it undivided.

Remark.

To conclude. The general Rules which we have propos'd for Pedeftals, cannot be obferv'd on all Occafions, it being frequently neceffary to vary Heights and Breadths to accommodate them to the Parts that encompafs them, for Inftance, the Pedeftal A, fhou'd be as broad as both the Bafes of the Pilafters it fupports; whereas the Die of the Pedeftal B, fhou'd only be the Breadth of the Pilafters that fupport it. See Plate XXVII.

That the Parts which enter the *Compofition* of a Building fhou'd be made for one another.

In raifing any Edifice, as for Inftance, a Church, Regard muft be had to the Joinery that is to be ufed in it, and Care taken, that all the Parts of the Architecture, whether they belong to the Joinery or Mafonry, may appear as if they had been the Work of the fame Undertaker. Without this Precaution, a Man will fcarce do any thing that is tollerably confiftent; as we find frequently the Cafe, when the Architect, and Joiner follow each their particular Humours, and Inclinations. Can any thing, for Inftance, be more ridiculous, than to fee the Bafes of grand *Orders* of Columns, or Pilafters, covered with Seats, and Confeffionals; or to fee the Tops of feveral large Pillars, appearing over fome little Balluftrade, or Gallery; it is in vain to urge that thefe are Magnificent Seats, and Confeffionals; and that the Gallery is a Mafterpiece of Art, nobody difallows all this; but the Misfortune lies here, that thefe Works, beautiful as they are, are ill placed, and are found to hide others, more beautiful than themfelves.

Seats, and even Chappels, and Oratories, may be contrived at the Foot of a large *Order*, where there may be Room for a Gallery, and a Choir of Mufick to be placed with Advantage.

Obfervations.

Galleries made entirely open, and placed over one another in the Height of fome grand *Order* of Columns, or Pilafters, whereof we have feveral Inftances in PALLADIO, ought not to be imitated.

Care muft be taken to avoid making a Balluftrade, between Columns, or Pilafters, without Pedeftals; in regard the Apparatus, and Difpofition neceffary for a Balluftrade is there wanting.

Two Ordonnances of Architecture, fhou'd never be placed within one another; a little one within a great one, with Defign only to compofe a fingle one; as we fee done in many Places.

Columns of different Bigneffes, and different *Orders*, fhou'd never be placed by the Side of one another, for they cannot chufe but make a very unpleafing Difcord.

When one wou'd add any Piece of Architecture, as a Pavillion, or Turret, for Inftance, to a Building already made, it muft be remembered, that it muft be made of fome other *Order*. Care muft likewife be taken, that the additional Piece may appear to have been directed by the fame Architect, who had the Management of the reft of the Building.

I wou'd never have any *Order* of Columns, painted on a flat Cieling, much leſs on a vaulted Roof, in regard for one little Spot or Point of View, whence ſuch a Piece of Architecture wou'd have its Effect; when there are a Thouſand others, whence it wou'd appear deformed and monſtrouſly out of the Perpendicular, unleſs the Vault be very high, and very narrow too.

An intelligent Architect will never allow ſuch elevated Places to be painted with Pieces of Hiſtory, or other Matters relating to our Earth; where ſuch Subjects muſt be extremely unſuitable. If it be the Dome of a Church, he may paint the Heavens open, a Glory, an Aſcenſion, ſome Saint carried up by Angels: In a Word, ſome Subject that relates to Heaven. He may indeed introduce People at the Bottom, leaning over a Balluſtrade, and viewing attentively what paſſes above.

When an Architect is not provided of an able Painter fit to manage a Work of this Kind, he had better content himſelf with fine Compartments, which may be made extremely rich, and will be infinitely more ornamental than a Hiſtory Piece, when it is ill conducted.

SECTION VII.

Firſt, containing a Deſcription of ſeveral Sorts of STAIRS.

This and the following Sections *are taken from the* London PALLADIO.

GREAT Care ought be taken in placing of the *Stair Caſe* in any Building; but commonly the *Stairs* are placed in the Angle, Wing, or Middle of the Front.

To every *Stair Caſe* are required their proper Openings.

Firſt, the Door leading thereto; Secondly, the Window or Windows that give Light to them; and Thirdly, their Landing.

Firſt, the Door leading to a *Stair Caſe* ſhou'd be ſo placed, that moſt of the Building may be ſeen before you come at the *Stairs*, and in ſuch a manner, that it may be eaſy for any Perſon to find it out.

Secondly, for the Window, if there be but one, it muſt be plac'd in the Middle of the *Stair Caſe*, that thereby the whole may be enlighten'd.

Thirdly, the Landing of the *Stairs* ſhou'd be large and ſpacious, for the convenient entering into the Rooms: In ſhort, *Stair Caſes* ſhou'd be ſpacious, light, and eaſy in Aſcent, the Height of the large Steps muſt never be leſs than ſix Inches, nor more than $7\frac{1}{2}$ Inches.

The Breadth of Steps ſhou'd never be leſs than 10 Inches, nor more than 18 Inches; and the Length of them be not leſs than 3 Feet, nor more than 12 Feet.

In making of *Stair Caſes*, this Rule ſhou'd be obſerved, that the Number of Steps at every Landing ſhou'd be odd, and never even; for thereby when you begin to aſcend with the right Foot firſt, (as all Perſons generally do) you will end with the ſame Foot alſo.

Of the ſeveral Sorts of *Stair Caſes*, and firſt of making them. See Plate XXXII.

Tho' there are Rules laid down for the Height and Breadth of Steps, yet Workmen are not to be ſtrictly tied to thoſe Rules, as not to vary in the leaſt from them; for they muſt ſtill obſerve to make all the Steps of the ſame *Stair Caſe* of an equal Height and Breadth: To do which, they muſt firſt conſider the Height of the Room, as alſo the Width or Compaſs, they have to carry up the *Stairs* in; then to find the Height of each particular Step; they ought firſt to propoſe the Height of each Step, and by that propoſed Height, divide the whole Height of the Room, which done, the Quotient will ſhew the Number of Steps; but if the Diviſion falls not out exact, but that there be a Remainder, then (in this Caſe) take the Quotient, not regarding the Remainder, for the Number of Steps, and by that Number divide the whole Height of the Room, ſo the Quotient ſhall give you the exact Height of each Step. Example.

Suppoſe the whole Height of the Room to be 9 Feet 3 Inches, and you deſign to make each Step 6 Inches, turn the whole Height of the Room into Inches, and divide thoſe Inches by 6, the Quotient will be 18, and the Remainder 3, therefore take 18 for the Number of Steps, and by it divide 3, the Quotient will be $6\frac{1}{6}$ Inches, which muſt be the exact Height of each Step.

Then to find the Breadth of each Step, divide the Space or Compaſs (that you have to carry them up in) by the Number of Steps, the Quotient will ſhew you the Breadth of each Step.

Of the ſeveral Kinds of *Stairs.* Plate XXXII.

There are many Kinds of *Stair Caſes*; for in ſome the Steps are made ſtrait; in others winding; in others mixt of both. Of ſtrait *Stairs*, ſome fly directly forward, others are ſquare; others are triangular; others are by ſome called *French* Flights, or winding *Stairs*; (which in general are called ſpiral or cockle *Stairs*) of which ſome are ſquare; ſome circular or round, and ſome eliptical or oval; and theſe again are various, for ſome wind about a Solid; others about an open Newel; *Stairs* mixt of ſtrait and winding Steps, are alſo of various Kinds; as ſome are called Dog-legg'd; ſome there are that wind about a ſolid Newel, and others that fly about an open ſquare Newel.

There might be a larger Deſcription given of every one of theſe Kinds of *Stair Caſes*; but if theſe are well underſtood, it will be eaſy to compoſe other Sorts from the following Figures.

Of *Strait Stairs.* See A.

Theſe are ſuch as always fly, and never wind, and are by ſome called Flyers; going directly from one Floor to another, without turning to the Right or Left.

Square Flyers, B.

Theſe fly round the Sides of a ſquare Newel, either ſolid or open, and are of two Kinds; and at every Corner of the Newel is a Foot-pace, that takes up a quarter of a Circle.

French Flyers C.

Theſe kind of Stairs, firſt fly directly forward, 'till they come within the Length of a Step of the Wall, and then they have a quarter Pace, from which you immediately, without any Steps between, aſcend to another quarter Pace; and from this ſecond quarter Pace, the Stairs fly directly back again, parallel to the firſt Flight.

Mixt Stairs. D.

Theſe are ſuch as do both Fly, and Wind, and therefore are by ſome called by the general Name of Flyers, and Winders, here is alſo ſhewn, a twiſted Rail, at the beginning of the firſt Flight.

Winding Stairs. E F.

Theſe are ſuch as always Wind, and never Fly, there are many kinds of Stairs, that Wind round either, a Circle, an Oval, a Square, or an equilateral Triangle; and of each of theſe, ſome Wind round a ſolid Newel, or Poſt, as F; and others round an open, or hollow Newel, as E.

Triangular Flyers, as G.

Theſe Fly round by the Side of a triangular Newel, either ſolid, or open, and are of two Kinds, at each Corner of the Newel, is a Trapezial foot Pace, that takes up $\frac{1}{3}$ of a Circle, the Length of the Stairs is at right Angles, with the Side of the Newel.

SECTION VIII.

Of ROOFS, Plate XXXIII, XXXIV, XXXV.

THE firſt Thing to be conſidered in *Roofs*, is the Covering wherewith the Building is to be incloſed, as Lead, Pan-tiles, Slates, or plain Tiles; they each requiring more Pitch or Slope, than the other; for which you muſt obſerve the following Rules.

Figure A, is a proper Pitch for covering with Lead.

To find the perpendicular Height, divide the Breadth of the Building into 4 equal Parts: and ſubdivide between 1, and 2, or 2, and 3, into 4 equal Parts; then take half the Building, and one of thoſe Parts, added together, for the Length of the Rafter; which ſaid Length, being uſed as a Radius, deſcribe the Arches in the upper Angle near A, which will give the perpendicular Height.

Fig. B, is a proper Pitch for covering with Pantiles, and Slate. To find the Perpendicular Height; divide the Breadth of the Building alſo into 4 equal Parts; again divide 1 of the middle Parts into 2, and take half the Building, and one of thoſe Parts for the Length of the Rafter. Do as before to find the Height.

Fig.

Fig. C, is a proper Pitch for covering with Pantiles. To find the Length of the Rafter, divide the Breadth of the Building into 4 equal Parts, and take 3 of thofe Parts for the Length of the Rafter.

This is called true, or common Pitch, it being moft in ufe, to Cover either with Pantiles, or Slates. In thefe three Examples is alfo fhewn, the Manner of Framing Timber on the Beams, which ferve to trufs, and ftrengthen the Rafters, which ought always to be carefully obferved.

But to make this Treatife more ufeful, I have in the following Figures, added a great Variety of Trufs *Roofs*.

Fig. D, is a flat *Roof*, having but $\frac{1}{6}$ of the Span for its perpendicular Height, and muft be Covered with Lead, and the Rafters thus joggled into the Beams, (which are made Camber) will be fubftantial.

Fig. E, is another flat *Roof*, rifing fomewhat higher, the perpendicular Height being $\frac{1}{5}$ of the Span; and with thefe Truffes, will be very ftrong; alfo here is fhewn, how Drips may be made to Walk on.

Plate XXXIII. Fig. F, is a *Roof* partly flat; of a different Kind to all the others, it rifes $\frac{1}{4}$ of the Span, and by fcarfing, or piercing of the Beams together, in this Manner, will be capable of Spanning any Breadth whatfoever, and if Room fhou'd he wanting in the Middle of the *Roof*, the Braces may be omitted.

Fig. G, is for a curved Ceiling, and although the Beam, or Tie, be hereby interrupted, yet, by this Manner of Trufs, this *Roof* will be exceeding ftrong.

Fig. H, is formed, that if the foregoing Pitch for plain Tiles is judged to be too lofty; then by this Method of having a Gutter in the Middle, $\frac{1}{3}$ of the Height of the *Roof* is taken off, as is plain by the Divifion of this Figure, and thefe are called M *Roofs*, from their Likenefs to an M.

Figures I, and K, are *Roofs* fit for Temples, or Summer Houfes.

Of the *Hip Roof*. Plate XXXV.

Inftructions to find the Length, and Back of the Hip Rafter, fo as it may anfwer the Side, and the End of the perpendicular Line, of the gable End, the two Skirts, the Side of the *Roof*, whether in Plans, or lying in Lodgment with the Hip, and Gable; the Diagonal, and perpendicular Lines being laid down proportional to any Length, or Breadth. Example Plate XXXV. Fig. 1.

Let A B C D, be the Sides, and Ends of the *Roof*, one End to be hipped, and the other a gable End; draw the Lines A B C D, the Breadth, and Length of that *Roof*, then draw the gable End A H B, whofe Sides A H, and B H, are each equal in Length to $\frac{3}{4}$ of the Width of the Houfe, or true Pitch, then draw the perpendicular Line O H, the Height of the gable End, which Lines, are of fingular, or general Ufe, to level the Ridge of all *Roofs*; and if the other End be hipped, as in the Defign C D E, then it ferves to find the Length, and Back of the Hip; fo that it may anfwer both Sides, and Ends of the *Roof*, always obferving, that the Middle of the Breadth of the Houfe is, as O V, then draw the Line S W X F, through the Centre Q, which will make right Angles to the Line O V, both in fquare, and level Houfes, and the Diftance W S, and X F, are each equal to the Length of the Rafters A H, or B H; then extend the Line A B, on both Sides to T, and I, and to the Length alfo I F, and S T, make the Length of the Ridge Q O, and S C, and D F, the two Skirts.

To find the Length of the Hip, draw the diagonal Lines C Q, and D Q, over which the Hip is to hang, when in its due Place; then take the perpendicular Line O H, and place it from the Point Q, to the Points R, R; the one Perpendicular to the diagonal, or bafe Line, C Q, and the other to Q D; fo is Q R, and Q R, the Pitch of the Hip, equal to the gable End O H, and when erected, will hang perpendicular to the Point Q, then take the Lines C R, and R D, placing them from C, to E, and from D, to E, and it gives the Length of the Hip C E D, and when laid to their Pitch, all will meet Perpendicular to the Point I.

To find the Back of the Hip, fo that it may anfwer to both Sides, and Ends of the *Roof*, whether fquare, or bevel.

Lay a Rular from the Point H, to the Point V, and from the Point V to X, and W, and mark where it cuts the diagonal Lines C Q, and Q D, at Z Z; then fet one Foot of your Compaffes, in the Point Z, and extend the other Foot to the neareft Diftance on the Hip Lines C R, and D R, and with that Diftance, mark the Points G G, upon the fame diagonal Lines; then draw the pricked Lines W G V, and V G X, which makes the Back of the Hip for the two Corners of the *Roof*.

Of the *Roof* bevel at one End, and fquare at the other; the gable End fquare, the bevel End hipped, Figure 2d.

Suppofe the Breadth of the Houfe to be 20 Feet, the Length more on one Side, than on the other, as in the Defign C N E P; then draw the gable End C A E, whofe Sides, from C, to A, and from A to E, is $\frac{3}{4}$ of the Breadth of the Houfe, or is the Length of the principal Rafters, then draw the perpendicular A D, the Height of the *Roof*, from the Floor, and if kneed, then from the Top of the Knee.

The Sides of the *Roof*, B G F Q. to be drawn as is described in the foregoing Design.

Divide the Breadth of the House, into two equal Parts, and draw the Line D L R; then take the Distance L V, which is the half Breadth of the House, and make it parallel to N R P, H L K, and L will be the Point, whose Perpendiculars, I L, and T L, will be the principal Rafters, and Hips.

To find the Length of each *Hip*, distinct one from the other, and first of the Longest *Hips*.

Draw the diagonal Line P L, and make the Height of the gable End D A, and place it Perpendicular to P L, at I, so have you the Height of the Perpendicular from P L, equal to D A, the gable End; and the Line P I, will be the Length of the *Hip*, and S P, the Side of the hipped End.

To find the Back of the longest *Hip*, I P; lay a Rular from the Point K, to R, and mark where it cuts the diagonal Line at M, then set one Foot of your Compasses in the Point M, and extend the other Foot, till it touches the Line I P, at the nearest Distance; then make it touch the diagonal Line at O, then draw the Lines K O, O R, which is the back of the *Hip*, for that corner of the Roof.

To find the shortest *Hip*, I N, is all the same as to find the Length of the longest *Hip*, and the backing of the shortest *Hip*, is also found by the same Method, as is already explained, or taught, and needs no other Explanation.

N. B. This Rule serves for all bevel Roofs, let the Pitch, or Slope be what it will.

Of a *Roof*, bevel at both Ends, and broader at one End than the other. Fig. 3.

Suppose A B C D, the length, and breadth of the House, and I M N, Fig. 4. the length of the Rafters, or Pitch, between the widest and narrowest End, about the Middle of the House, to stand over the pricked Line S O, K K are the Points of the two hipped Ends, which, when brought to their due Place, will be perpendicular to P, and P, and will meet the Sides F H, G I, over the same Points P, and P; the Points XX = XX, are the Perpendiculars, and Length of the *Hips*, from A B C D; the Points W, W, W, W, shew the Back of the *Hips*, or the Hip Mould due to each Corner, and V, V, V, V, are the Points to find out the Points W, W, W, W, for each Back, R T, Z Z, are the Lines representing ½ the Breadth of the House, parallel to each End, and y y represents the Middle of the House: Notwithstanding the bevel Ends, you may place the Beams for your principal Rafters, to stand on a Square, or so near a Square as may be, or between both, as from the Ends of the Lines F G, H I, bringing the outside of them strait under P, which will be more handsome for the House withinside, although it bevels outward.

And so much for *Roofing*, and all its Parts.

SECTION IX.

To measure the Works of the several Artificers concerned in Building; together with an Account of the Prices of their several Works, and Materials, also the Quantity of Materials required to the Performance of each particular Sort of Work. *viz. Carpenters, Joyners, Bricklayers, Plaisterers, Masons, Glaziers, Painters, Plumbers, Paviours,* and *Smiths.*

And first, of *Carpenter's* Work.

THE principal Work done by *Carpenters*, is framing the Fronts of Timber-Houses; also Roofs, Partitions, Floors, *&c.* Boarding on the Floors, which are commonly performed by the Square of 10 Feet every Way for Workmanship; and for the Timbers, by the cubical Foot.

The principal Things to be observed in taking these Dimensions, are as follows.

First, to Measure the Body of a Timber Building; take the Length of one Side, and one End, and add them together, and their Sum multiplied into the Height, taking from the Underside of the Cill, to the Upside of the Raising, gives the Content of one Side, and one End; which being doubled, is the Content of the whole Building in Feet; to bring which into Squares, divide it by 100, the superficial Feet contained in one square of Framing; and the Quotient is the Answer required.

Of

Of Roofs.

When you take the Dimenfions of a *Roof*, meafure the Length of the Rafter, and Length of the *Roof*; and afterwards the Steps by themfelves, inftead of allowing flat and half the common Way; meafure alfo the Gable-ends by themfelves, as is taught before for the meafuring of a Triangle. See the Menfuration of fuperficials. Lib. I. Plate I.

Of Floors.

In naked flooring, you are to allow 7 or 10 Inches for the Length of the Joifts laid in the Wall.

In boarded Flooring, you muft take your Dimenfions to the very extreme Parts; out of which Deductions muft be made for Stair Cafes, Chimnies, *&c.*

1. For the Prices of Timber ufed rough, and not framed, fawing and Nails included, at 2 *s.* 6 *d.* in Oak; and 2 *s.* in Fir per Foot Cube.
2. Ditto framed in Roofs, naked Flooring and Partitions at 3 *s.* in Oak, 2 *s.* 6 *d.* Fir.
3. Ditto plained and framed in Door-cafes and Window-frames, at 3 *s.* 6 *d.* Oak, 2 *s.* 8 *d.* Fir.
4. Extra Work in truffing of Beams 6 *d.* per Foot Oak; 4 *d.* per Foot Fir running.
5. Rafters, Feet, and Eve Boards, at 4 *s.* per Foot running.
6. Guttering and Bearers of Oak, 8 *d.* per Foot, of Fir 6 *d.* fuperficial.
7. Plain outfide Cornices out of whole Deal, at 9*d.* per Foot fuperficial.
8 Ditto with plain Modillions or Dentils, at 18 *d.* per Foot.
9. Centring to Doors and Windows, 2 *d.* per Foot.
10. Ditto to plain Arches for Vaults, *&c.* at 10 *s.* per Square.
11. Groins, at 15 *d.* per Square.
12. Cove Brackettings of Oak, 6 *d.* per Foot, Fir 5 *d.* per Foot fuperficial.
13. Steps of common Stairs, Strings and String-boards and Bearers included of Oak, at 9 *d.* per Foot fuperficial on the Raifer and Tread; of Fir 6 *d.* per Foot.
14. Ditto of fecond beft Boards, Strings, Bearers, and plain Brackets included, at 9 *d.* per Foot.
15. Ditto with clean Deals and carv'd Brackets, from 12 *d.* to 18 *d.* per Foot.
16. Rails and Ballufters 2 Inches fquare, at 2 *s.* per Foot running; 3 Inches fquare, at 2 *s.* 6 *d.* 4 Inches fquare at 3 *s.* per Foot, running.
17. If circular or ramping allow the Price double, or otherwife double Meafure, which is a Rule for all circular Works in general.
18. Of boarding, rough whole Deal fhot at 25*s.* per fquare Workmanfhip only 3 *s.* per Square.
19. Folded joint boarding clear of Sap, at 28 *s.* per Square, Workmanfhip, 5 *s.* per Square.
20. Common ftrait joint boarding clear of Sap at 35 *s.* per Square, Workmanfhip 7 *s.* 8 *d.* per Square.
21. Second beft boarding nail'd at 45 *s.* per Square, Workmanfhip 8*s.* per Square.
22. Ditto dowelled 50 *s.* work 12 *s.* per Square.
23. Clean Deal Floor dowell'd 90 *s.* per Square, work 18 *s.* per Square.
24. Long Boards 15 Feet or upwards, 6 *l.* per Square, work 21 *s.* per Square.
25. Second beft Floors taken up, re-laid and planed over, 16 *s.* per Square.
26. Boarding with rough flit Deal 14 *s.* per Square, work 2*s.* 6*d.* per Square.
27. Lining of Walls, Plugs and Nails included, 18 *d.* per Yard, work, 9 *d.* per Yard.
28. Ditto, groov'd, tongue'd, and plain'd at 2 *d.* per Foot fuperficial.
29. Weather boarding, Feather-edg'd, at 18*s.* per Square.
30. Whole Deal planed on one Side, 2 *s.* 6 *d.* per Yard; work, 10 *d.* per Yard.
31. Ditto on both Sides, 3 *s.* per Yard, work, 12 *d.* per Yard.
32. Ditto, groov'd, tongu'd, ledg'd or battined, 3 *s.* 6 *d.* per Yard, work, 15 *d.* per Yard.
33. Ditto, lined with flit Deal, 5 *s.* per Yard, work, 2 *s.* per Yard.
34. Whole Deal, and flit Deal grooved, Partitions planed on both Sides, 2 *s.* per Yard, fingle Meafure, work 10 *d.* per Yard.
35. Two Inch Stuff planed on one Side, 3 *s.* per Yard, work, 12 *d.* per Yard.
36. Ditto, planed on both Sides, 3 *s.* 8 *d.* per Yard, work, 17 *d.* per Yard.
37. Ditto, groov'd, tongu'd, ledg'd or battin'd, 4 *s.* 6 *d.* work 20 *d.* per Yard.
38. Two Inch Planks lifted and fhot clear of Sap of Oak, 8 *d.* per Foot, of Fir, 5 *d.* per Foot.
39. Three Inch thick of Oak, 9 *d.* per Foot, Fir, 6 *d.* per Foot.
40. Ditto, four Inch thick of Oak, 14 *d.* per Foot, Fir, 10 *d.* per Foot.

41. Dreſſers of whole Deal, with Shelves and Bearers, 6 *d.* per Foot ſuperficial.

42. Ditto, double Deal, at 9 *d.* per Foot.

43. Elm or Beech Dreſſers, at 3 *s.* 6 *d.* per Foot, Cube.

44. Aſhlering, or cieling Floors, Stuff 4 by 3 Inches, at 16 *s.* per Square.

45. Workmanſhip of framing naked Flooring, with binding Joints of Oak, 9 *s.* per Square, of Fir, 8 *s.* per Square.

46. Ditto, with Girders and Joiſts of Oak, 8 *s.* per Square, of Fir, 7 *s.* per Square.

47. Workmanſhip of ſingle Roofing, Plates included of Oak, 8 *s.* per Square, of Fir, 6 *s.* per Square.

48. Ditto, framed with Purlines, and Collar-beams of Oak, 12 *s.* per Square, of Fir, 10 *s.* per Square.

49. Fencing with rough whole Deal Poſts and Rails, the Stuff to be turn'd, 13 *s.* per Square.

50. Paliſading Poſts of Oak 6 Inches ſquare, Rails 5 Inches; Pales 3 Inches by 1 ½ Inch of Oak at 4 *s.* per Foot running, of Fir, 3 *s.* per Foot.

51. Saſh Windows, Saſh Window-frames, Work and Materials, are at 7 *d.* per Foot; ſo alſo are the Saſh Lights; but for the Workmanſhip of the Saſh Frames, the Price is from 2 *s.* to 2 *s.* 6 *d.* a Piece, and for making the Saſh-Lights from 2 *d.* to 3 *d.* per Foot.

Of *Wainſcotting*, or Joiner's Work.

Wainſcotting is a Work generally done by the Joiners, and is meaſur'd by the Yard ſquare, and their Dimenſions are taken in Feet and Inches, thus: They girt down every Moulding, with a String, contain'd between the Ceiling and the Floor, which they take for the Height of the Room, and the Circumference of the Room they take for the Length, deducting the Chimneys from thence, if of Stone; but if Wood, no Deduction is made; the Seats of Windows, Cheeks, Sophetas, Linings, &c. are all to be taken by themſelves; alſo Doors, Window-ſhuts of whole Deal, are allowed work and half, if of 2 Inch Stuff, in regard to their being worked on both Sides.

To make this the more plain, I ſhall ſhew the Method of taking the Dimenſions by an Example of one Room that is wainſcotted, which will be ſufficient for any Number of them.

The *Price.*

1. *Wainſcotting* with *Norway* Oak, Work and Materials, 7 *s.* per Yard, Work only 2 *s.* per Yard.

2. Ordinary Bolexion *wainſcotting* with Deal, 4 *s*, per Yard, work, 18 *d.* Yard.

3. Large Bolexion *wainſcotting* with *Dantzic* Stuff, 6 *s.* per Yard, work, 2 *s.* per Yard.

4. Deal *wainſcotting* with quarter round plain Pannels raiſed at 4 *s.* per Yard, work 15 *d.* per Yard.

5. Deal *wainſcotting*, with quarter round plain Pannels, 3 *s.* per Yard, work 12 *d.* per Yard.

6. Plain ſquare *wainſcotting* with Deal, 2 *s.* 6 *d.* per Yard, work 10 *d.* per Yard.

7, All Mouldings whatſoever, that are not wrought with common Planes, but work'd by Hand (as the Joiners commonly phraſe it) as impoſt Mouldings, Baſes, Architraves, Pilaſters, Columns, Cornices, &c. are to be meaſured in ſuperficial Feet, and to allow for the ſame from 12 *d.* to 18 *d.* per Foot, work only from 6 *d.* to 9 *d.* per Foot, according to the Goodneſs of the Work; except there is an Agreement to meaſure theſe Mouldings in, at the Price of the *Wainſcott*, as is ſometimes done.

8. Modillion or double Cornices, have more Labour, and more Materials beſtow'd on them, and are worth for every Foot in Heigth about 1½ *d.* per Inch girt, and for work, 1 *d.* per Inch girt.

Of *Bricklayers Work.*

Here, I ſhall ſhew all that is needful for the Performance of *Bricklayers Work*, not only in the Method of meaſuring, but alſo the Prices of the ſeveral Kinds of Work done by them.

But firſt it will be neceſſary, to conſider the Digging out the Cellars or Foundations; for till that be done, the *Brick-work* cannot be begun.

Digging then is a Work done by the Yard Cube or ſolid Meaſure containing 27 Feet, or 3 Feet every way, *viz.* in Length Breadth and Depth.

In taking the Dimenſions they are not ſo exact, as in other Works, for they rarely take them nearer than a Quarter of a Foot.

The principal Work in building performed by *Bricklayers* is walling and tyling, and what is to be obſerved therein is,

1. That the Meaſure by which *Brick-work* is to be meaſur'd is a ſquare Rod, or 16½ Feet, whoſe Square is equal to 272¼ Feet.

2. That

2. That the Manner of meaſuring Brick Work, hath no ſort of Difference from any other ſuperficial Meaſure, if the Thickneſs be but equal to the Standard Thickneſs, *viz.* $1\frac{1}{2}$ Brick.

3. To reduce Brick Work of any Thickneſs, to the ſtandard Thickneſs of $1\frac{1}{2}$ Brick. Reduce the Thickneſs of the Wall to half Bricks, the which, if you divide by 3, the Quotient will give you what you want, or require.

4. Obſerve the ſeveral Thickneſſes of the Walls, and that you make every Deduction out of its proper Thickneſs, alſo, that when you meaſure two Walls that conſtitute an Angle, the Length of one muſt be taken on the Outſide, and the other on the Inſide.

5. When you meaſure Chimnies, meaſure them as a ſolid Wall, and deduct the Vacancy between the Jaumbs, and the Mantil, the Funnels are allowed Solid, in regard to the Trouble of them, and pargetting the Inſides. Example.

To bring any Number of Feet of Brick Work into Rods, is thus done.

Multiply the Feet given, by 16, which are the ſquare Quarters in a Foot, and then divide by 4356, being the ſquare Quarters in a Rod, and the Quotient is the Number of Rods; and the Remainder, if any, divide by 16 will be Feet.

Example. The Materials required in a Rod of Brick-Work, reduced to the Standard, are 4500 Bricks, $1\frac{1}{2}$ *C.* of Lime, and $2\frac{1}{2}$ Loads of Sand; in ſound, and new Work, a *Bricklayer* will lay 1000 Bricks in a Day, at which Rate, one Rod of Brick-Work will amount to, for Work, and Materials, 5 *l.* 10 *s.* or 6 *l.* and for Work alone 16 *s.*

There are other Kinds of Brick-Work, performed by the foot Meaſure, and ſuch are Facias, Arches over Doors, Windows, *&c.* Architraves, Frizes, Corniceps, Ruſtics, Returns, Peers, Columns, Pilaſters, *&c.* all which are valued according to the goodneſs of the Work; but rubbed Arches of any Sort, are done for 12 *d.* a Foot, for Work only, but for Work, and Materials, 18 *d.* or 20 *d.* per Foot.

Of Tyling, which is meaſured by the ſquare of 10 Feet, as Carpenters Meaſure their Roof; you muſt obſerve in taking the Dimenſions of Tyling, that you Meaſure the whole Length, that is, as far as the Tyles are laid, for your Length, and take from the Ridge, to the Eves, for your Breadth, or Depth, and thereby you will have the true Contents of the Tyling required. When many Hips, and Vallies happen in a Roof, every Foot running, muſt be added to the Meaſure, as ſquare Feet.

The Quantity of Materials required in a ſquare of Tyling at a 9 Inch Gage, will be 665 Tyles, and at a 7 Inch Gage, 740 Tyles, one Peck of Tyle Pins, $2\frac{1}{2}$ Buſhels of Lime, 5 Buſhels of Sand, and one Bundle of Laths; there is required 500 Nails, at 6 Score to the Hundred; and commonly one Square is accounted a Days Work, of a Trowel Man, and Labourer; the Charge for Work, and Materials, is about 30 *s.* per Square.

Of Thatching, which is a Work performed by the Square, as the Tyling, and is Meaſured the ſame way; the Materials required in Thatching, are Straw, Laths, Nails, Withes, and Rods; one Load of Straw will do $1\frac{1}{2}$ ſquare, one Bundle of Laths one Square, one Hundred of Withes will do 3 Squares, and to a Square of Thatching, there is required $2\frac{1}{2}$ Hundreds of Nails. The Price of a Square of Thatching, for Work only, is 4 *s.*

Of *Plaiſterers* Work.

Plaiſterers Work is of two Kinds, namely,

1. Work lathed, and plaiſtered, called Ceiling; 2. Work rendered, which is alſo of two Kinds, *viz.* Rendering upon Brick Work; or in Partitioning between Quarters, the principal Thing to be regarded herein, is (1) to make Deductions for all Chimnies, Doors, or Windows; and Meaſuring the Jaumbs, and Heads; (2) If the Workman finds Materials for rendering between Quarters, you muſt Deduct $\frac{1}{5}$ for Quarters, Braces, *&c.* But if Work only is found, you muſt make no Deduction, for the Workman wou'd have performed the whole much ſooner, if there had been no Quarters there. (3) In Meaſuring Whiting and Colouring between Quartering, there muſt be $\frac{1}{5}$ allowed extraordinary for the Returns of the Quarters.

The above mentioned Work, is performed by the Yard ſquare, ſuperficial Meaſure, at the Prices following, *viz.*

Pargetting, or *Plaiſtering*, is of divers Kinds, as (1) with Lime, and Hair Mortar laid upon bare Walls, at 4 *d.* per Yard; (2) Upon bare Laths, as in Partitioning, and plain Ceiling, from 8 *d.* to 14 *d.* per Yard ſquare, (3) Rendering in Partitions, at 2 *d.* or 3 *d.* per Yard, (4) Rough-caſt upon Heart-Laths, from 1 *s.* to 3 *s.* per Yard; (5) *Plaiſtering* upon Brick Work, with finiſhing Mortar, in Imitation of Stone Work, from 18 *d.* to 2 *s.* per Yard; (6) And the like upon Heart Laths, from 2 *s.* 6 *d.* to 3 *s.* per Yard, all plain Mouldings, if ſtrait, at 6 *d.* per Foot ſuperficial, if circular, 9 *d.* per Foot ſuperficial; inriched ſtrait Mouldings, at 12 *d.* Circular, at 18 *d.* per Foot.

In all theſe Works, the Scaffolding is to be conſidered, and the Quantity of Lime, and fine Sand, for finiſhing Mortar, muſt be equal.

Of *Maſons* Work.

Maſons Work is meaſured by the Foot, either ſuperficial, or ſolid, and ſometimes both; the Dimenſions are taken in Feet, Inches, and Parts; the Solids, are Blocks of Marble, or any Kind of Stone,

Stone, Columns, Cornices, *&c.* It is to be obferved, that *Mafons*, firft meafure the Cube of the Stone, and then fuperficial plain Work, alfo, fuperficial moulded Work, if any, the Superficies are Pavements, Slabs, Chimney Pieces, *&c.*

Suppofe a folid moulded Aftragal Step to be meafured, which is 10 Feet, 2 Inches long, 13 Inches wide, and 6 Inches high, how many of each Sort is contained therein.

Firft, 10 Feet, 2 Inches, multiplied into 13 Inches, produces 11 Feet, 0 Inch, 2 Parts; which being multiplied by 6 Inches, the laft Product fhall be 5 Feet, 6 1/12 Inches, for the folid Content.

But for Chimney Pieces, *&c.* they are perfectly fuperficial, therefore, take the Dimenfions as follows, which may ferve as a Rule for many.

The length of the Mantil, and Slab, is 4 Feet, 9 Inches, the breadth of the fame, 3 Feet, 1 Inch, which multiplied, produces 22 Feet, 5 7/12 Inches. So that fuch a Chimney Piece, contains 22 Feet, 5 1/2 Inches; but fometimes there are Marble Slips, Nofings, and Covings, which are alfo meafured fuperficial in the fame Manner, and at the following Prices, *viz.*

1. Black and White vein'd *Italian* Marble, at 2 *s.* per Foot, cube.
2. Superficial plain Work, on ditto, at 3 *s.* per Foot.
3. Superficial moulded Work, on ditto, at 5 *s.* per Foot.
4. Slabs of ditto, in Chimney Pieces, at 5 *s.* per Foot, fuperficial.
5. Purple Marble in ditto, at 8 *s.* per Foot, fuperficial.
6. Dove Marble, at 6 *s.* per Foot, fuperficial.
7. Fire-ftone Hearths, and Covings, at 12 *d.* per Foot, fuperficial.
8. Port-land black, at 2 *s.* 3 *d.* per Foot, cube.
9. Superficial plain Work on ditto, at 18 *d.* per Foot.
10. Superficial moulded Work on ditto, at 2 *s.* per Foot.
11. Portland Slab, in Chimney Pieces, 1 1/2 Inch thick, at 18 *d.* per Foot.
12. Ditto, if two Inches thick, at 2 *s.* per Foot.
13. Portland Paving, in ftrait Courfes, at 18 *d.* per Foot, ufed in Halls, *&c.*
14. Ditto, octagon, and black Dots, at 2 *s.* per Foot.
15. Black and white Marble fquares, at 2 *s.* 6 *d.* per Foot, fuperficial.
16. Purbeck Paving, at 7 *d.* per Foot, fuch as Yards, Foot-ways, or Areas, are paved with.
17. Portland Aftragal Steps, at 3 *s.* 6 *d.* per Foot, running.
18. Plain ditto, at 3 *s.* per Foot, running Meafure.
19. Purbeck Steps, at 2 *s.* per Foot, running.
20. Portland coping, for common Houfes, at 18 *d.* per Foot, running Meafure, being about one Foot wide, 3 Inches edge, 1 1/2 Inches the other in thicknefs.
21. Beft, when large, to be cubed firft, and then meafured, fuperficial plain Work.
22. So alfo, Portland Cirbs, for Iron Worked, *&c.* muft be firft Cubed, and then meafured, fuperficial plain Work.
23. Alfo, the Holes cut in the fame for Iron Work, at 2 *d.* per

N. B. Thefe Prices, (efpecially in the Marble) muft fometimes be augmented, according to the beauty, and goodnefs of the Stone.

Of *Glazers* Work.

Glazers Work is meafured by the fuperficial Foot, and the Dimenfions may be taken in Feet, Inches, and Parts; but more accurately in Feet, and the hundredth Parts of a Foot, as their Rules are generally divided; the principal Things to be obferved therein, are thefe.

Where Windows are all of one Size, you need Meafure but one, and obferve the Number of Times accounted for them all.

To meafure circular, or oval Windows, take the fame Length, and Breadth of their Diameters, as if they were fquare Windows, becaufe in cutting out the Quarries of Glafs, there is a great Wafte, and more Time expended therein, than if it had been a fquare Window.

Again, in meafuring Squares of Safhes, no more than one need be fet down, caft up, or meafured; for having one multiplied by the whole Number, will give the Contents of them all.

1. The *Glazing* with Squares, or Quarries in Lead Work, is 5 *d.* per Foot.
2. Cafements pinned, at 3 *d.* each.
3. Safhes *Glazed* with Crown Glafs, puttied on both Sides, and Brads included from 11 *d.* to 12 *d.* per Foot.
4. Ditto with New Caftle, at 7 *d.* and 8 *d.* per Foot.
5. Ditto waved, or jealous Glafs, at 2 *s.* 6 *d.* per Foot.
6. Ditto with plate Glafs, Diamond cut, from 1 to 2 Foot, at 5 *s.* per Foot.
7. Ditto from 2 to 3 Foot, at 5 *s.* 6 *d.* per Foot.
8. Ditto from 3 to 4 Foot, at 6 *s.* per Foot.

Of

Of *Painters* Work.

Painters Work is meaſured in the ſame Manner as the *Joiners*, only with this Difference, that inſtead of accounting the Doors and Window Shutters Work and half, they have double Work, as being painted on both Sides, and they alſo meaſure all Edges, *&c.* where the Bruſh goes.

1. Saſh Frames, Saſh Lights, Window Lights, and Caſements, are done by the Piece.
2. Modillion, and other outſide Cornices, are valued by the Foot, running Meaſure.
3. Outſide *Painting*, 3 Times in Oil, is worth, if well done, from 5 *d.* to 6 *d.* per Yard; Inſide *Painting*, new Work, of common Colours; at 6 *d.* per Yard.
4. Inſide *Painting* old Work of common Colours, at 4 *d.* per Yard. But of extraordinary Colours, as,
5. Olive Colours, at 8 *d.* per Yard.
6. Pruſſian Blue, at 10 *d.* per Yard.
7. Green, at 12 *d.* per Yard.
8. Saſh Frames, at 12 *d.* per Yard.
9. Saſh Lights, at 1 *d.* per Yard.
10. Window Lights, and Caſements, at 3 *d.* per.
11. Iron Bars, at 1 *d.* per Bar, or more if very large.
12. Modillion Cornice, from 4 *d.* to 8 *d.* per Foot, running.
13. Common outſide Cornice, at 2 *d.* per Foot, running.

N. B. All Carving in Rooms, and outſide Frontiſpieces to Doors, *&c.* are ſo various, that they muſt be valued by the Time, and Materials expended.

Of *Colours* uſed in Houſe Painting.

Painting, if not the chief, is as neceſſary a Part of Building, as any other whatever, both for Uſe, and Ornament, the doing of which well and often, being the ſureſt Way of preſerving all the Reſt; Inſtances of which, may be ſeen in ſeveral Buildings about *London*, where the Misfortunes of the Builders, have prevented them from finiſhing their Works; it may be obſerved that the Saſh Frames, Saſh Window Shutters, Doors, and Door Caſes, for want of Painting, in a very few Years, are ſo much decayed, that were thoſe Buildings to be made Tenantable, moſt of the outſide Timber Works muſt be renewed; Iron-Work, tho' of a much ſtronger Nature than Timber, if not well ſecured by Painting, is likewiſe ſubject to the ſame Misfortune; on the contrary, if Timber Work be often painted, it will endure many Ages, no Weather being able to penetrate thro' it; as to the Ornamental Part, there is no Gentleman but muſt allow, that there is a great Difference between a clean painted Room, and one that hath not been painted, or where the Painting is foul.

I ſhall be more particular under this Head of *Colours*, Painters Work being very expenſive, and this being the only Part in Building, wherein a Gentleman can be aſſiſting, either by himſelf, or Servant, it being almoſt impoſſible, for any Gentleman to do either Maſons, Carpenters, Bricklayers, or Smiths Work, whereas it is well known, and daily experienced, ſince the Advertiſement of *Alexander Emerton*, that ſeveral Noblemen, and Gentlemen, have by themſelves, and Servants, painted whole Houſes, without the Aſſiſtance, or Direction of a Painter, which, when examined by the beſt Judges, could not be diſtinguiſhed from the Work of a profeſſed Painter.

And that which conduces moſt to this Practice, is the vaſt Diſproportion between the Prices which Painters charge for their Work, and the Expence which Gentlemen are at in this Method of Painting; which at the utmoſt does not amount to ⅕ of the Painters Prices of Colours. And I ſhall likewiſe ſhew, what Number of Yards, one Pound of each *Colour* will paint.

Firſt primer, ground in Oil, at 36 *s.* per Ct. or 4 *d.* per lb. one Pound of which will paint 20 ſquare Yards.

Second primer, ground in Oil, 36 *s.* per Ct. 1 Pound of which will paint 20 ſquare Yards.

Beſt white Lead, ground in Oil, at 36 *s.* per Ct. 1 Pound of which, with 2 *d.* worth of Oil, will paint 8 ſquare Yards, which is 3 Farthings per Yard, for which Painters uſually charge 4 *d.* per Yard.

Pearl Ground, at 4 *d.* or 5 *d.* per lb.
Lead Colour, ditto.
Cream Colour, ditto.
Stone Colour, ditto.
Wainſcot, or Oak, ditto.

One Pound of any of theſe *Colours*, with Oil, will paint 8 ſquare Yards, for which Painters uſually charge 4 *d.* per Yard.

Chocolate Colour ground in Oil, at 6 *d.* per lb.
Mohogany Colour, at ditto.
Cedar Colour, at ditto.
Wallnut-tree-Colour, at ditto.

One Pound of any of these *Colours*, with Oil, will paint 10 Yards square, for which Painters usually charge 4 *d.* per Yard square.

Gold colour, ground in Oil, at 8 *d.* per lb.

Olive Colour, from 8 *d.* to 12 *d.* per lb.

Fine Sky Blue, mixt with Prussian Blue, ground in Oil, is from 8 *d.* to 12 *d.* per lb.

Orange Colour, at 12 *d.* per lb.

Lemmon Colour, at ditto.

Straw Colour, at ditto.

Pink Colour, at ditto.

Blossom Colour, at ditto.

One Pound of any of these *Colours*, mixt with Oil, will Paint 8 square Yards, for some of which Painters usually charge 10 *d.* or 12 *d.* per Yard; for others, they will expect more.

Fine deep green, ground in Oil, at 2 *s.* 6 *d.* per lb. 1 lb. of which, with Oil, will paint 20 square Yards; for which Painters usually charge 12 *d.* per Yard.

Oils used in House Painting, are,

Linseed *Oil*, at 10 *d.* per Quart.

Turpentine *Oil*, at 12 *d.* per Quart.

Best drying *Oil*, at 12 *d.* per Quart.

Painting Brushes, at several Sizes, from 2 *d.* to 6 *d.* each.

Putty, at 4 *d.* per lb.

Double Size, used by the Painters, for priming new Work, at 4 *s.* per Ferkin, or 2 *d.* per Quart.

Single Size, at 18 *d.* per Ferkin.

Of *Plumbers* Work.

Plumbers Work is done by Weight, *viz.* the great Hundred, or 112 lb. in covering of Flats, Roofs, Guttering, *&c.* there is generally allowed from 7 to 10 lb. to the Foot, superficial.

1. All Sheet Lead, either cast or mill'd, Solder and Labour included, at 20 *s.* per Ct.
2. Ditto, exclusive of Solder and Labour, at 18 *s.* per Ct.
3. All Rain-water Pipes, Rain-water Cisterns, batten'd Cisterns, Lead Pumps, Solder, and Labour included, at 22 *s.* per Ct.
4. All Water Pipes, from 3 Quarters bore, Labour and Solder included, at 20 *s.* per Ct.
5. Soldering the Joints of Water-Pipes, for 3 qrs. bore at 2 *s.* 6 *d.* per Joint.

	s.	*d.*
6. Ditto, for 1 Inch,	3	0
7. Ditto, for $1\frac{1}{2}$ Inch,	3	6
8. Ditto, for 2 Inches,	4	6
9. Ditto, for $2\frac{1}{2}$ Inches,	5	6
10. Ditto, for 3 Inches,	7	0
11. Ditto, for $3\frac{1}{2}$ Inches,	8	6
12. Ditto, for 4 Inches,	10	0
13. Ditto, for $4\frac{1}{2}$ Inches,	11	6
14. Ditto, for 5 Inches,	13	0
15. Ditto, for $5\frac{1}{2}$ Inches,	14	6
16. Ditto, for 6 Inches,	16	0
17. Ditto, for $6\frac{1}{2}$ Inches,	19	0
18. Ditto, for 7 Inches,	21	0

19. Sash Weights, and other things of the like Nature, at 18 *s.* per Ct.
20. Solder, at 8 *d.* per lb.
21. Brass Cocks, and Bosses, from 3 Inches, to $1\frac{1}{4}$ Inch Diameter, at 1 *s.* 3 *d.* per lb.
22. Brass Cocks and Bosses, Solder and Labour included; as also setting on, and all Charges; $1\frac{1}{2}$ Inch Diameter, at 7 *s.* 6 *d.* per lb.
23. Ditto, $1\frac{1}{4}$ Inch, at 5 *s.* 6 *d.* per.
24. Ditto, 1 Inch, at 4 *s.* 6 *d.* per.
25. Ditto, $\frac{3}{4}$ Inch, at 3 *s.* 6 *d.* per.
26. Ditto, $\frac{1}{2}$ Inch, at 3 *s.* per.
27. If not Bosses, deducted from the small ones 4 *d.* the Middle Size 6 *d.* and the largest 8 *d.* each.
28. Stop Cocks, at 1 *s.* 3 *d.* per lb.
29. Ditto, with setting on, Solder, Labour, *&c.* included $1\frac{1}{2}$ Inch Diameter, at 8 *s.* 6 *d.* each.
30. $1\frac{1}{4}$ Inch, at 7 *s.* per.
31. 1 Inch, at 5 *s.* 6 *d.*
32. $\frac{3}{4}$ Inch, at 4 *s.* 6 *d.*
33. $\frac{1}{2}$ Inch, at 3 *s.* 6 *d.*
34. Ball Cocks, the Ball 6 Inches Diameter, the Cock 1 Inch, at 12 *s.*
35. Ditto, $5\frac{3}{4}$ Inches Diameter, 9 *s.*
36. Ditto, $4\frac{1}{2}$ Inches Diameter, 6 *s.*
37. Ditto, $3\frac{1}{2}$ Inches Diameter, 4 *s.*
38. Ditto, $2\frac{1}{2}$ Inches Diameter, 3 *s.*
39. To allow for all old Lead, 14 *s.* per Ct.

Of

Of *Paviors* Work.

Paviors Work is meafured by the Yard fquare, of 3 Feet every way.

For the underftanding of how many *paving* Tyles, Bricks, &c. will *pave* a Cellar, Vault, &c. obferve.

That $\left\{\begin{matrix} 36 \\ 20\frac{1}{4} \\ 16 \\ 13 \\ 9 \end{matrix}\right\}$ Tyles $\left\{\begin{matrix} 6 \\ 8 \\ 9 \\ 10 \\ 12 \end{matrix}\right\}$ Inches fquare, will be fufficient to *pave* a Yard fquare.

The *Prices*.

1. New pebble *Paving*, not lefs than 14 Inches deep, finding Materials and Work, 3 *s.* 6 *d.* per Yard.

The Pebbles in each Yard ought to be 3 Ct. Weight.

2. 15 Inches deep, finding Work and Materials, 4 *s.* per Yard, the Pebbles in each fuch Yard, ought to weigh, 4 Ct.
3. From 16, to 18 Inches deep, finding Work and Materials, at 4 *s.* 6 *d*, per Yard, the Pebbles in fuch Yard, ought to weigh 5 Ct.
4. New Perbeck fquare *Paving*, 6 Inches thick, 5 *s.* per Yard.
5. If the hard blue Sort, at 6 *s.* per Yard.
6. New Flanders-Brick *paving*, at 3 *s.* 6 *d.* per Yard.
7. New Perbeck fquare *paving*, 4 Inches thick, 4 *s.* 6 *d.* per Yard.
8. If the hard blue Sort, 5 *s.* per Yard.
9. New rag *Paving*, or Bowlers, at 2 *s.* 6 *d.* per Yard.
10. Pebble *Paving*, or rag taken and new laid, Gravel included, at 6 *d.* per Yard.
11. Perbeck *Paving*, Work only and Gravel included, at 6 *d.* per Yard.
12. Flanders-Brick *Paving*, ditto, at 5 *d.* per Yard.
13. Pebbles, at 20 *s.* per Ton.
14. Gravel, at 2 *s.* 4 *d.* per Load.
15. Raggs, at 10 *s.* per Ton.
16. Flanders-Bricks, at 20 *s.* per Thoufand.

Of *Black Smiths* Work.

Black-Smiths Work is done by the Pound Weight.

1. Cafements for Windows, Crofs Window-bars filed, and Work of the like Nature, at $4\frac{1}{2}$ *d.* per Pound.
2. Iron Doors, and Shutters, at 10 *d.* per lb.
3. New Keys to Locks, from 1 *s.* to 2 *s.* each.
4. All hammered Work, as Chimney-bars, Stays, upright Window-bars, Iron Fenders, Shutter-bars, Pump-Work, Bolts, Saddle-bars, Cramps, Hold-fafts, Wall-hooks, Gudgeons, Hoops, and all *Black-Smiths* Work, of the fame Nature, at $3\frac{1}{2}$ *d.* per lb.
5. Pins, Hoops, Chains, Hooks, &c. to Stable Rails, at 4 *d.* per lb.

Here followeth, an exact Account of fuch Nails, Hinges, Locks, and Tools, and their Prices, as are ufed in Buildings, which have been obtained with great Pains, and Expence from the refpective *Smiths*, and therefore may be depended upon.

Of *Nails*.

The general Sorts are, Bill-brads, Gunners-brads, Plain-brads; Die-hops, Rofe-hobs, Skidder-hobs, Thick-hobs, Lead Nails, Draw Nails, Defk Nails, Rofe Nails, Flat-head Nails, Middle Nails, Prigg Nails, Scupper Nails, Flat-pointed Nails, Sharp Nails, Square Nails, Spike Nails.

N. B. All the above Sorts are fold by the 1000, and including them all, they are from 8 *d.* to 12 *d.* per 1000.

Such of them as Weigh per 1000, are to be feen in the following Table, containing 4 Columns, for Pounds, Ounces, and Price.

Weight

Weight lb.	oz.	Prices. s.	d.
0	$2\frac{1}{4}$	0	8
0	5	0	$8\frac{1}{4}$
0	6	0	$8\frac{1}{2}$
0	7	0	9
0	9	0	$9\frac{1}{4}$
0	14	0	11
1	0	0	$11\frac{1}{2}$
1	8	1	1
1	12	1	$1\frac{3}{4}$
1	14	1	$2\frac{1}{2}$
2	0	1	$2\frac{3}{4}$
2	8	1	$4\frac{3}{4}$
2	14	1	$6\frac{3}{4}$
3	0	1	7
3	8	1	$8\frac{1}{2}$
3	12	1	10
4	4	1	11
4	12	2	1
5	0	2	$2\frac{1}{2}$
5	4	2	3
5	8	2	4
5	12	2	6
6	0	2	7
6	12	2	$8\frac{1}{2}$

Weight lb.	oz.	Prices. s.	d.
7	0	2	$9\frac{1}{2}$
7	8	2	$11\frac{1}{2}$
8	0	3	$0\frac{1}{2}$
9	0	3	3
10	0	3	6
12	0	4	1
13	0	4	6
15	0	5	0
16	0	5	3
18	0	5	10
19	0	6	2
20	0	6	5
21	0	6	8
23	0	7	3
24	0	7	6
26	0	8	2
27	0	8	6
30	0	9	2
36	0	11	0
40	0	12	0
Batten-brads.			
0	8	0	$8\frac{1}{2}$

Weight lb.	oz.	Prices. s.	d.
0	14	0	11
1	0	0	$11\frac{3}{4}$
1	12	1	3
2	0	1	4
2	12	1	9
2	14	1	10
3	0	1	11
4	0	2	4
5	9	2	10
Clout Nails.			
4	8	2	$1\frac{1}{2}$
7	0	2	10
9	0	3	6
Jobent Nails.			
0	14	0	$10\frac{1}{2}$
1	0	0	$11\frac{1}{4}$
1	14	1	$2\frac{1}{2}$
2	0	1	3
2	3	1	$6\frac{1}{2}$

Weight lb.	oz.	Prices. s.	d.
Dog-Nails.			
9	0	3	9
12	0	4	9
16	0	5	9
Round-head N.			
0	13	0	$11\frac{1}{2}$
1	0	1	0
1	10	1	3
2	0	1	$4\frac{1}{2}$
3	4	1	11
5	0	2	8
7	0	3	3
10	4	4	3
13	6	5	5
Glazer's Sprigs.			
0	3	0	$7\frac{1}{2}$
0	14	0	$8\frac{1}{3}$
1	0	0	$8\frac{3}{4}$

Flat-pointed Nails, are ſold by the hundred Weight.

N. B. There are other larger Sizes, from 20 lb. to 100 lb. per 1000, ſold at 4 *d.* or $4\frac{1}{2}$ *d.* per lb.

Ribbing Nails, of which are ſeveral Sorts, from 5 to 10 Inches, and are ſold at 27 *s.* per Hundred.

Timber Nails are of ſeveral Sorts, *viz.* from 6, to 15, or 16 Inches, and are ſold generally, at 30 *s.* the Ct. weight.

Joiners Rivits, are ſold by the lb. *viz.* thoſe of 1 Inch, at $4\frac{1}{3}$ *d.* thoſe of $1\frac{1}{2}$ Inch, at $4\frac{1}{2}$ *d.* thoſe of $1\frac{3}{4}$ or thoſe of 2 Inches, at $4\frac{3}{4}$ *d.*

Caſement-hooks are ſold by the Groſs, *viz.* thoſe which weigh 53 lb. per 1000, at 2 *s.* 9 *d.* thoſe that Weigh 70 lb. per 1000, at 3 *s.* 6 *d.* per.

Tent-hooks, are ſold by the 1000, *viz.* thoſe that weigh 1 lb. at 1 *s.* 4 *d*; 1 lb. 8 oz. at 1 *s.* 6 *d*; 3 lb. 8 oz. at 2 *s.* 3 *d*; 5 lb. 8 oz. at 3 *s.* 5 *d*; 10 lb. 6 oz. at 4 *s.* 6 *d*; 18 lb. 8 oz. at 7 *s.* 6 *d*; and thoſe that weigh 39 lb. 8 oz. at 15 *s.* 6 *d.*

Curtain-hooks, are ſold by the Groſs, *viz.* weighing 21 lb. at 1 *s.*

H L, Hinges, the beſt Sort, are ſold per Pair, *viz.* thoſe of 6 Inches, at 9 *d*; 7 Inches, at 10 *d*; 8 Inches, at 14 *d*; 9 Inches, at 15 *d*; 10 Inches, at 18 *d*; 11 Inches, at 2 *s*; and 12 Inches, at 2 *s.* 10 *d.* per Pair.

H L Hinges, with riſing Joints, are ſold per Pair, *viz.* thoſe of 7 Inches, at 15 *d*; 8 Inches, at 17 *d*; 9 Inches, 1 *s.* 10 *d*; 10 Inches, at 2 *s*; 11 Inches, 3 *s.* and 12 Inches, at 3 *s.* 10 *d.* per Pair.

Pew-hinges are ſold by the dozen, *viz.* thoſe of ſix Inches at 9 *s.* 9 *d.* 7 Inches at 13 *s.* 8 Inches, 17 *s.* 6 *d.* 9 Inches at 20 *s.* 6 *d*, 10 Inches at 26 *s.* per dozen.

Shutter-hinges are ſold by the dozen, *viz.* thoſe of 6 Inches at 7 *s.* 6 *d.* 7 Inches at 10 *s.* 6 *d*, 8 Inches at 12 *s.* 9 Inches at 16 *s.* 9 *d.* per dozen.

Side-hinges are ſold by the dozen. *viz.* thoſe of 5 Inches at 5 *s.* 6 Inches at 6 *s.* 7 Inches at 8 *s.* 9 *d.* 8 Inches at 10 *s.* 6 *d.* 9 Inches at 12 *s.* 9 *d.* 10 Inches at 13 *s.* 6 *d*, per dozen.

Dove-tail'd Hinges, the beſt ſort are ſold by the Pair, *viz.* thoſe of 3 Inches, at 3*s.* $3\frac{1}{2}$ Inches, 4*s.* 4 Inches 4*s.* 6*d.* $4\frac{1}{2}$ Inches 5*s.* 6*d.* 5 Inches, at 5*s.* 9*d.* per Pair.

Black Hinges, Cheſt-hinges, Cheſt-haſps, Hooks and Hinges, Scuttle-hinges, Strap-hinges, all theſe are ſold by the dozen and are from 3*s.* 6*d.* to 11*s.* per dozen, *viz.* 3*s.* 6*d.* 6*s.* 3*d*; 7*s.* 9*d*; 8*s.* 6*d*; and 11*s.* per dozen.

4 D. Gate-locks, if 2 wards, 3 wards, ſteel-wards, ſlit-key, or letter-key, are ſold by the dozen, *viz.* from 2*s.* 9*d*; 2*s.* 10*d.* &c. to 14*s.* 6*d.* per dozen.

Hanging-locks, Pad-locks, ſlit-keyed-locks, are ſold by the dozen, *viz.* from 3*s.* 6*d*; 4*s.* 6*d*, &c. to 16*s.* 6*d.* per dozen.

Bridge

Bridge and secret pad-locks, some are sold from 9*s.* 6*d.* to 16*s.* 6*d.* per dozen.

Some are sold singly, *viz.* from 1*s.* 8*d.* to 5*s.* 9*d.* each.

Cabinet-locks, Box-locks, Cupboard-locks, Till-locks, whether in suite or not, are from 3*s.* 9*d.* to 16*s.* 6*d.* per dozen.

Cabinet-locks, Till-locks, Scrutore-locks, not in suite, from 2*s.* 6*d.* to 7*s.* 6*d.* per suite.

N. B. There are higher priced Ones, but not of common Use.

Of inside Locks for Chests, Desks Tills, Cupboards and Boxes are sundry sorts, *viz.* X Keys, X Wards XX Wards XX and Bullet-wards, and are sold from 3*s.* 10*d.* to 37*s.* 6*d.* per dozen.

Ditto, not sold by the dozen, from 2*s.* 3*d.* to 11*s.* each.

X Garnet-hinges with rising Joints are sold by the dozen, from 6*s.* 9*d.* to 16*s.* per dozen.

X Garnet and Scuttle-hinges that are weighty, are sold, at 33*s.* per Ct.

X Garnet Hinges, filed Joints, are sold at 38*s.* per Ct.

Hinges with Hooks are sold at 30*s.* the Ct.

N. B. Sometimes they have stay'd Hooks, and then they are 2*s.* or 2*s.* 3*d.* more by the Ct.

Cheaper Hinges there are, such as *Lancashire*-hinges, Balcony-hinges, Chest-hinges, Dove-tailed-hinges X Garnet-hinges, and Side-hinges, which are sold by the dozen, from 13*d.* to 31*s.* per dozen.

Smooth-filed-hinges, *viz.* Balcony, Box-hinges, Chest-hinges, Clock-case-hinges, Desk-hinges, Pew-hinges, Shutter-hinges, and Side-hinges, are sold by the dozen, from 1*s.* 8*d.* to 43*s.* 6*d.* per dozen.

Smooth-filed-hinges, some are sold by the pair, from 4*s.* to 7*s.* 6*d.*

Holdfast and Wall-hooks, are sold at 33*s.* per Ct.

Ditto, for Joiners are sold at $4\frac{1}{2}$*d.* per lb.

Hooks and Eyes for Gates, are sold at $3\frac{1}{2}$*d.* or $3\frac{3}{4}$ per lb.

Long Tuma Latches are sold by the dozen from 2*s.* 6*d.* to 8*s.* per dozen, of which there are Sorts.

Varnish Latches, of which are six sorts, and are sold by the dozen, from 2*s.* 7*d.* to 8*s.* 3*d.*

Spring and Thumb-latches, whereof are 9 sorts, and are sold by the dozen, from 3*s.* 7*d.* to 14*s.* 9*d.*

Latches with Brass Knobs are sold by the dozen, *viz.* the first sort at 14*s.* the second, at 16*s.* and the third sort, at 18*s.* per dozen.

Rimm'd Latches are of sundry Sizes.

N. B. Of these, some are Iron cased, some Brass cased and some sliding cased, and are sold single, and are from 2*s.* to 15*s.* 6*d.* each.

Plate Closet-locks are sold by the dozen from 11*s.* to 20*s.* per dozen.

Plate Closet-locks with double Screws, are sold single from 12*s.* 6*d.* to 17*s.* each.

Ditto, with single springs, are sold single, from 6*s.* 6*d.* to 9*s.* each.

Bastard *Banbury* Stock-locks are sold from 6*s.* to 9*s.* per dozen.

Plate Stock-locks are sold, from 8*s.* 6*d.* to 26*s.* per dozen.

Livery Stock-locks are sold, from 8*s.* 6*d.* to 25*s.* per dozen.

Spring Stock-locks, twice dead and spring, are sold, from 2*s.* 3*d.* to 10*s.* each.

Spring Locks twice dead, are sold in suite from 11*s.* 6*d.* to 40*s.* per suite.

Balcony-bolts, some are sold by the dozen, from 6*s.* to 29*s.* per dozen.

Some are sold by the pair from 3*s.* 3*d.* to 13*s.* per pair.

Spring-bolts and Sash-bolts, are sold from 18*d.* to 10*s.* per dozen.

Shutter-bolts are sold from 10*s.* 6*d.* to 18*s.* per dozen.

Workmens Tools, are sold as follows.

Adzes at 20*d.* or 2*s.* a piece according to the size.

Augres are sold singly, *viz.* those of $\frac{1}{2}$ Inch, 1*s.* 1 Inch 18*d.* $1\frac{1}{4}$ Inch 2*s.* $1\frac{3}{8}$ Inch 2*s.* 6*d.* $1\frac{1}{2}$ Inch 2*s.* 9*d.* $1\frac{3}{4}$ Inch 3s. 3*d.* and 2 Inches 4s. 3*d.* per Inch.

Brick Axes are sold from 2*s.* to 2*s.* 6*d.* or 3*s.* each according to the size.

Felling Axes are sold singly, *viz.* Number I. 18*d.* Number II. 19*d.* Number III. 2s. Number IV. at 2s. 2d. each.

House Axes are sold from 2s. 6d. to 3s. 9d. each.

Lopping Axes are usually sold by the dozen, *viz.* Number I. at 17s. 6d. Number II. 18s. 6*d.* Number III. 23 *s.* Number IV. at 25 *s.* per.

Chisels, Firmers, and Gouges shouldered, are usually sold by the Dozen, *viz.* those of 1 Inch or under, at 1 *s.* 9 *d*; $1\frac{1}{2}$ Inch 2 *s.* 2 *d*; 2 Inches 2 *s.* 9 *d.* per Dozen.

Mortise Chisels are 4 *s.* 6 *d.* per Dozen; pairing Chisels, 7 *s.* 6 *d.* or 8 *s.* per Dozen, the second Sort are 8 *s.* or 9 *s.* per Dozen; broad Chisels are 7 *s.* or 8 *s.* per Dozen; heading Chisels $\frac{1}{2}$ Inch at 4 *s.* 6 *d*; $\frac{3}{4}$ Inch 6 *s.* 6 *d*; 1 Inch 7 *s.* Scribling Chisels are 5 *s.* 6 *d*; per.

Turning Chisels and Gouges are 6 *s.* per Dozen; Socket Gouges are 5 *s.* 6 *d.* per Dozen.

Compasses, of these are 6 or 7 Sizes, and are sold from 1 *s.* 8 *d.* to 3 *s.* per Dozen.

Compasses with Steel Sweeps, are sold by the Pair, *viz.* those of 12 Inches at 2 *s.* 4 *d*; 13 Inches at 3 *s*; 14 Inches at 3 *s.* 3 *d*; and 15 Inches at 3 *s.* 4 *d.* a Pair.

Timber Dogs are sold at 29 *s.* per Ct. wt.

Gimblets are sold from 6 *d.* to 6 *s.* per Dozen.

Claw-hammers are sold from 2 *s.* 9 *d.* to 8 *s.* per Dozen.

Welded-cheek Hammers are sold from 11 *s.* 6 *d.* to 16 *s.* 6 *d.* per Dozen.

Lathing-hammers are sold from 10 *s.* 6 *d.* to 15 *s.* per Dozen.

Round-poled Hatches are sold from 6 *s.* 6 *d.* to 10 *s.* per Dozen.

Square-poled Hatches are sold from 8 *s.* 9 *d.* to 16 *s.* 6 *d.* per Dozen.

Joiners Hatches are sold from 18 *s.* to 21 *s.* per Dozen.

Pinchers for Joiners, Farriers, and Shoemakers, are sold from 4 *s.* 6 *d.* to 45 *s.* per Dozen.

Compass Steel Saws are sold by the Dozen, *viz.* those of 12 Inches, at 8 *s.* 3 *d*; and at 15 Inches, 10 *s.* 6 *d.* per Dozen.

Grafting Saws are sold by the Dozen, *viz.* those of 10 Inches at 9 *s.* 6 *d*; of 12 Inches 12 *s.* 6 *d*; 14 Inches 14 *s.* 6 *d*; 16 Inches 16 *s*; and of 18 Inches at 18 *s.* per Dozen.

Hand and Pannel Saws are sold by the Dozen, *viz.* those of 20 Inches at 22 *s*; 22 Inches 25 *s.* 6 *d*; 24 Inches 28 *s*; and those of 26 Inches, at 30 *s.* per Dozen.

Hand and Pannel Saws hardened Plates, *viz.* those of 22 Inches at 4 *s.* 6 *d*; 24 Inches at 5 *s*; and 26 Inches at 5 *s.* 6 *d.* each.

Tenant Saws hardened Plates, are sold at 55 *s.* per Dozen.

Two-hand-peg Tooth, and whip Steel Saws, are usually sold Single, and are from 3 Foot at 6 *s.* 9 *d*; to 10 Foot at 45 *s.*

Ribb Steel Saws are sold Single, from 5 Foot at 8 *s.* 3 *d.* to 6 Foot at 10 *s.* 6 *d.* per.

Iron-hand Saws are sold from 8 *s.* to 16 *s.* per Dozen.

Iron-two-hand peg-Tooth and whip Saws are singly from 3 Foot, at 3 *s.* 3 *d.* to 7 Foot at 7 *s.* 9 *d.* each.

Stone Saws are at 36 *s.* per Ct. wt.

Hand Saw Screws are at 6 *s.* 6 *d.* per Gross.

Hand-saw Sets are sold at 2 *s.* per Dozen.

Ditto the very best at 3 *s.* per Dozen.

Trowels for Bricks are sold at 10 *s.* per Dozen.

Laying Trowels at ditto.

Stoping Trowels at 8 *s.* per Dozen.

Setting Trowels at 9 *s.* per Dozen.

Stone Trowels at 10 *s.* 6 *d.* per Dozen.

Spades, Number (1) sold at 2 *s.* 6 *d.* Number (2) at 3 *s.* Number (3) at 3 *s.* 6 *d.* per.

Jacks or Hand Screws single, are sold per Pair, *viz.* those of ½ Inch at 17 *s*; ¾ Inch 25 *s.* 6 *d.* ⅞ Inch 26 *s.* 6 *d.* 1 Inch 30 *s.* 1¼ Inch 32 *s.* and 1½ Inch 40 *s.* per Pair.

Jacks, or Hand Screws (double) are sold by the Pair, *viz.* those of 1¼ Inch at 42 *s*; and those of 1½ Inch at 44 *s.* per Pair.

A Table shewing briefly the Prices of common Materials *used in Building.*

	£.	s.	d.
For Bricks, the Thousand,	0	16	0
For Tyles, the Thousand,	1	5	0
Lime, the Hundred, or 25 Bushels,	0	12	0
Sand, the Load, *i. e.* 36 Bushels,	0	3	0
9 Inch Paving Tyles, the Hundred,	0	10	0
Gutter Tyles, the Hundred,	0	12	0
Hair, the Bushel,	0	1	0
Rough Timber, the Load, or 40 Feet,	2	0	0
Timber cut to Scantlings, the Load,	4	0	0
Plank, the Load,	5	0	0
Tyle Pins, the Bushel,	0	1	6
Withes for Thatching, the Hundred,	0	0	6
5 Foot Laths, heart of Oak, the bundle,	0	2	2
4 Foot Laths, ditto.	0	1	11
5 Foot Laths, sap of Oak, the Bundle,	0	1	6
4 Foot, ditto,	0	1	4

How to estimate the Charge of erecting a House of any Height and Bigness, built of Brick and Timber.

Before

Before any Gentleman or others begin to erect a Building, it is requisite to have Draughts or Designs, drawn upon Paper, Vellum or the like, not only for Ease and Expedition, but for preventing Mistakes in carrying on the intended Edifice; and will also be of use to prevent the many Errors that may otherwise occur in the Estimation of the Cost and Charges thereof; and in large Fabricks, it wou'd be proper to have a Model made either of Past-board, Wood, Clay, or the like; for thereby the whole Structure wou'd be seen at one view in Miniature; but however, that you may give a near Estimate of the Charges of the erection of any Edifice, you must have given you, first the Dimensions thereof; not only in Length and Breadth, but in Height also, in respect of the Number of Stories; for by the Length and Breadth you may find the Number of Squares upon every Floor; and also in the Roof and Tyling; by the Height you may calculate the Number of either Rods or Perches of Brick Work continued in the Wall round about; and the partition Walls, if any be; and also the Chimnies; then consider how many pair of Stairs, and of what kind; how many Floors to lay, and what sort; what Timber in Sash Frames and Window Light, and of what Sort; also consider, what and how many door Ways, and Windows there are to Case; what Rooms to Wainscot, and what sort of Work; Iron Work, as Nails, Hinges, &c. and in short, all the several Works must be carefully remembered.

The Buildings of the City of *London* are valued according to their Rates, of which Rates there are four, *viz.*

1, 2, 3, 4	Stories, Cellars, and Garrets.	And the Naked Building or Shell of a House, the naked Floors being finished, is thus valued by the Square, or 100 Feet in High Street, *viz.*

1st.	Rate at	25 *l.*	per Square.
2d.		35 *l.*	
3d.		45 *l.*	
4th.		50 *l.*	

But these Rates may be augmented at the Discretion of the Surveyor.

As some Artificers may be utter Strangers to decimal Arithmetick, of which I made use in my Mensuration of Surfaces and Solids; and as they generally take the Dimensions of their Work in Feet, Inches, and Quarters, I shall here by a few Examples shew how Feet, Inches, and Quarters, &c. may be multiplied by Feet, Inches, and Quarters.

N. B. I do not recommend this kind of Multiplication to any that understand Decimals; being attended with a vast difficulty and prolixity in the Operation; therefore in my Opinion ought to be rejected, without meer Necessity had not interfered.

How to Multiply Feet, and Inches, by Feet and Inches.

Let it be required to multiply 11 Feet, 4 Inches, by 7 Feet, 5 Inches; place the Numbers to be multiplied, in Order, one under another, *viz.* Feet under Feet, and Inches under Inches, making a Cross between the Feet and Inches, and drawing a Line under them, as in the Margin.

$$\begin{array}{ccc} 11 & & 4 \\ & \times & \\ 7 & & 5 \\ \hline \end{array}$$

The Product of 11 Feet, by 7 Feet, is	77	0	
The Product of 11 Feet, by 5 Inches, is	4	7	
The Product of 7 Feet, by 4 Inches, is	2	4	
The Product of 4 Inches, by 5 Inches, is	0	1	8

For the better understanding the foregoing Example, and all other Questions of the like Nature, observe the following Rule, *viz.*

I. That, if Feet are multiplied by Feet, the Product is Feet.

II. If Inches be multiplied by Feet, every 12 of the Product is 1 Foot, and any Number less than 12, is Inches.

III. If Inches are multiplied into Inches, every 12 of the Product is 1 Inch; and any Number less than 12, will be parts of an Inch.

IV. If parts of an Inch be multiplied by Feet, every 12 of the Product is 1 Inch, and any Number less than 12, is parts of an Inch.

V. If parts of an Inch are multiplied by Inches, every 12 of the Product, is 1 part of an Inch, and any Number less than 12, are Seconds.

VI. If parts of an Inch are multiplied by the parts of an Inch, every 12 of the Product is 1 Second, and every Number less than 12, are Thirds, as an Example.

Let it be required to multiply 15 Feet, 6 Inches, and a Quarter, by 12 Feet, 8 Inches, and 3 Quarters.

N. B.

N. B. That as a Foot contains 12 Inches line Meaſure, ſo an Inch is ſuppoſed (or accounted) to contain 12 Parts line Meaſure, and each Part to contain 12 Seconds; and each Second 12 Thirds; each Third 12 Fourths, *&c.* and the Proportion might be continued if there was Occaſion, to 5ths, 6ths, 7ths, *&c.*

Alſo obſerve, that each Place of Twelfths is diſtinguiſhed, by having a Letter put over it, thus, over the Feet write F; over the Inches write I; over Parts write P; over Seconds write S; over Thirds write T; *&c.*

Set down your Dimenſions as in the Margin, and read it thus, 15 Feet, 6 Inches, and 3 Quarters, of 12, which is $\frac{1}{4}$ Inch, by 12 Feet 8 Inches, and 9 Parts of 12, which is $\frac{3}{4}$ of an Inch.

	F.	I.	P.	S.	T.
	15	6	3	0	0
	12	8	9	0	0
The Product of 15 Feet, multiplied by 12 Feet, is	180	0	0	0	0
The Product of 8 Inches, by 15 Feet, is 120, which divided by 12, is	10	0	0	0	0
The Product of 6 Inches, by 12 Feet, is	6	0	0	0	0
The Product of 6 Inches, by 8 Inches, is	0	4	0	0	0
The Product of 3 Parts, by 12 Inches, is	0	0	3	0	0
The Product of 9 Parts, by 15 Feet, is	0	11	3	0	0
The Product of 3 Parts, by 8 Inches, is	0	0	2	0	0
The Product of 9 Parts, by 6 Inches, is	0	0	4	6	0
The Product of 3 Parts, by 9 Parts, is	0	0	0	2	3
The Total Product is	197	4	0	8	3

Note, That in caſting up the Sum, you muſt carry 1 for every 12, to the next Denomination, thus you will have the Area or Content of 15 Feet, 6 Inches, 1 Quarter in Length, multiplied by 12 Feet, 8 Inches, 3 Quarters, or 9 Parts in Breadth, which is 197 Feet, 4 Inches, 0 Parts of an Inch; accounting to have 12 Parts in an Inch, and 8 of 1 of thoſe Parts, and 3 of 1 of thoſe Seconds; but thoſe Seconds and Thirds, are not worth the ſetting down, or taking Notice of, the Value of them being ſo very ſmall.

Of *Architectonical Axioms,* and *Analogies.*

Of *Doors.*

That the Height of *Doors* be double their Breadth.

That *Doors* in general be proportionable to the Magnitude of the Rooms.

That the Breadth of the inner *Doors* be never leſs than 2 Feet, and a half, nor more than 6 Feet; that the *Doors* of the ſecond and third Stories, be placed exactly over the firſt. That an Arch of either brick or ſtone be turned over every *Door* to diſcharge the Weight that preſſes upon them; leſt they may ſome time or other ruin or deſtroy the Structure.

Of *Windows.*

That the Number and Bigneſs of *Windows,* be proportionable to the Rooms they are to enlighten, and their Height at leaſt double their Breadth, with the Addition of $\frac{1}{4}$, $\frac{1}{3}$, $\frac{1}{2}$ Part, as ſhall be found neceſſary. That the Height of the *Windows* in the ſecond Story, be $\frac{11}{12}$ of the Firſt; and the Height of the Windows in third, or attic Story, $\frac{3}{4}$ of thoſe in the ſecond Story. That the *Windows* be not placed too near the Angles of any Building, for thereby the Structure will be weakened. That over every *Window* be turned an Arch, to diſcharge the Weight that preſſes thereon. That no Girders be laid over any Door or *Window,* but always on the moſt ſubſtantial Part of the Brick or Stone, *&c.* that Solid may reſt upon Solid.

Of *Gates.*

That the Breadth of the principal *Gates* of Entrance, be never leſs than ſeven Feet and a half, nor more than 12 Feet.

That the Height of the principal *Gates,* or Entrances be never leſs than $1\frac{1}{7}$ of their Breadth, nor more than twice, which is the beſt Proportion.

Of *Halls.*

That the Length of the *Halls* be not leſs than twice the Breadth, nor more than 3 times. That the Height of *Halls,* whoſe Ceilings are flat, be not leſs than $\frac{2}{3}$ of their Breadth, or more than $\frac{3}{4}$ of the Length. That the Height of *Halls,* whoſe Ceilings are arched or coved, be not leſs than $\frac{5}{6}$, nor more than $\frac{11}{12}$ of their Breadth.

Of *Galleries.*

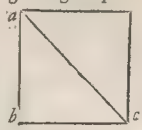
That their Sight be towards the North, on account that the North Light is the beſt for Paintings, Pictures, *&c.* That their Breadth be not leſs than 16 Feet, nor more than 24.

That

That the Length of the *Galleries* be not less than five times their Breadth, nor more than eight times at most. That their Height be equal to their Breadth, if with flat Ceilings; but if arched, or coved, $\frac{1}{3}$, $\frac{1}{4}$ or $\frac{1}{5}$ of the Breadth may be superadded.

Of *Anti-Chambers.*

That the Length of all *Anti-Chambers*, be equal to the Hypothenuse of a right-angled plain Triangle as *a c*, whose Legs *a b*, and *b c*, are each equal to the Breadth of the *Anti-Chamber*. That the Breadth of all *Anti-Chambers* be proportionable to the whole Structure. That the Height of *Anti-Chambers* be not less than $\frac{2}{3}$ of the Breadth, or more than $\frac{3}{4}$ of the Length, when the Ceiling is flat, and when arched or coved, not less than $\frac{5}{6}$, nor more than $\frac{11}{12}$ of their Breadth.



Of *Chambers.*

That all principal *Chambers* of delight be placed towards the best Prospect of the Country, if possible to the East.

That the Length of *Chambers* never exceeds $1\frac{1}{3}$ of their Breadth, therefore the Length may be the Breadth exactly, or the Breadth and $\frac{1}{4}$, $\frac{1}{7}$, $\frac{1}{6}$ or $\frac{1}{3}$.

That the Height of all *Chambers* of the first Story, if the Ceiling be flat, be not less than $\frac{2}{3}$ of the Breadth, or more than $\frac{3}{4}$ of the Length. That the Height of the *Chambers* of the second Floor be $\frac{11}{12}$ of the first Story. That the Height of the *Chambers* of the third or attic Story be $\frac{3}{4}$ of the Second.

Of *Floors.*

That the *Floor* of every Story in a Building, be truly Level throughout, so as to pass out of one Room into another, without going up or down Stairs; as is common in many Buildings.

That the Height of the Level of the first or ground Floor, be never less than 1 Foot, nor more than 4 Feet.

Of *Hall Chimnies.*

That the Proportion of *Hall Chimnies* be as follows, *viz.* their Distance between the Jaumbs from 6 to 8 Feet; their Height from $4\frac{1}{2}$ to 5 Feet; their Projection from $2\frac{1}{2}$ to 3 Feet at most; the Breadth of the Jaumbs from 9 to 20 Inches, as occasion may require; according to the Order that the *Chimney* is adorned with.

Of *Chamber Chimnies.*

The Proportion of *Chamber Chimnies* is as follows, *viz.* their Breadth from 5 to 7 Feet, their Height $4\frac{1}{2}$ Feet, and Projecture $2\frac{1}{2}$.

Of *Chimnies* in *Studies.*

The Proportion of *Chimnies* in *Studies* is as follows, *viz.* their Breadth from 4 to 5 Feet at most; their Height 4, and Projecture $2\frac{1}{2}$ Feet.

That the Funnels of Chamber *Chimnies*, or *Studies*, be not narrower than 10 Inches, or wider than 15, which is a good Size for the Kitchen *Chimnies.*

Of the *Funnels* of *Chimnies.*

That the *Funnels* of *Chimnies* be carried a sufficient Height above the Ridge, that Winds may have the less Power to beat the Smoak back.

That the *Funnels* of *Chimnies* be not too wide, because thereby the Wind may drive down the Smoak into the Room: Or too narrow, so that it cannot have a free Passage out.

That the *Funnels* of *Chimnies* be truly perpendicular, otherwise the Smoak cannot pass free.

That no Timber, Joists, &c. be laid nearer than 6 Inches to the Back of any *Chimney.*

That the *Funnels* of all *Chimnies*, have not any Timber, as Girders, Joists, &c. laid therein, lest some time or other they chance to take Fire.

Of *Joists*, *Rafters*, and *Girders.*

That the greatest Distance that *Joists*, or *Rafters*, are laid from each other, does not exceed 12 Inches; and Quarters in Partitions 14 Inches asunder. That no *Joists* bear at a greater Length than 12 Feet, or single *Rafters* more than 10 Feet.

That the Length of *Joists* laid in the Wall be not less than 7 Inches, and no *Girders* less than 9 Inches.

Of *Materials.*

I. That the Money and *Materials* be always ready from the beginning, or laying of the Foundation, to the turning of the Key, when the whole is compleated.

II. That great care be taken in the goodness of the Foundations, and that they be truly level.

III. That the Thickness of the Foundations, be double to the insistent Wall.

IV. That the Walls diminish in thickness, according to the Nature and Height of the Structure.

V. Care must be taken that the most heavy *Materials* be employed in the Foundations.

VI. That every Wall be built exactly perpendicular.

VII. That such Bricks as are not well burned, be not used in any Building.

VIII. That the depth of all Fabricks in the Ground-cellars, Vaults, &c. be $\frac{1}{7}$ of the whole Height; and thofe that have no Cellars, to be $\frac{1}{8}$ of the Height.

IX. That the Kitchen be fpacious and lightfome, and remote from the Parlour as poffible, and to be under Ground; as alfo the Pantry, Bake-Houfe, Still-Room, Buttery, Dairy, and Servants Offices in general.

X. That Cornices do not project too far, whereby the Windows may be darkened.

XI. That of all kinds of Arches, none is fo Strong as the Semi-circle.

XII. That the depth of all Ruftics be never more than one Foot, nor lefs than 9 Inches.

XIII. That the thicknefs of the Pilafters of Doors and Windows, be not more than $\frac{1}{5}$ of their Aperture, or Breadth, nor lefs than $\frac{1}{6}$.

XIV. That the projecture of Pilafters in general, be $\frac{1}{6}$ of their Breadth.

XV. That the Roofs of all Buildings be not too heavy, or too light, and that interior Walls fupport part of the fame.

XVI. That convenient Cifterns be well placed, plentifully to furnifh every Office with Water; and that proper Machines be made to raife the fame therein.

Laftly, that convenient Drains, to carry away Soil, &c. be well contrived, and fecretly placed with Vents to difcharge the noifome Vapours that ufually arife from them.

The Ufe and Defcription of the Table *for finding the* Diameter, *in Proportion to any Height of* Columns *or* Pilafters *throughout all the five* Orders *in* Architecture.

Plate XXXVIII. The firft Column towards the Left-hand, is the Height of the Column or Pilafter, in Feet and Inches from 5 to 12 Feet high in a gradual Afcent of 3 Inches. On the Top of the Table is writ, the Names of the 5 Orders, *viz. Tufcan, Doric, Ionic, Compofite,* and *Corinthian,* and fhews how many Heads in the Table goes to each Order, which is 4; and right under *Tufcan, Doric, &c.* is writ, the Variety of Cafes, that the Diameter is calculated to, *viz.* to the Column alone; the Column and Entablature; Column, Entablature and Pedeftal; and Column and Pedeftal only.

Thefe are all the variety of Cafes that can poffibly happen in Practice. In each Column there are two Rows of Figures; the firft of which are Inches, and the other fo many 16ths of an Inch. As an Example.

Let it be required to find the Diameter for erecting the *Doric* Column with its Entablature, to a limitted Height of 8 Feet, 6 Inches. Seek in the firft Column for 8 Feet 6 Inches; alfo on the Top of the Table under *Doric.* for Column and Entablature; and in the Angle of meeting you will find there fet down 10, 3, which fignifies 10 Inches, and $\frac{3}{16}$ of an Inch; which is the exact Diameter in proportion to the limitted Height required.

Proceed in the fame Manner for any other Order, in any Cafe whatever.

Note. That if you require the Diameter to any Height greater or lefs than is in the Table, proceed in this Manner.

If the Height is greater than any in the Table, feek for a Diameter to half that Height, and when found, double the Sum, and the Product is the Diameter fought.

Again, if the Height is lefs than any in the Table, feek for a Diameter that is double the Height, and take half thereof for the Diameter fought, and you have your defire,

Note alfo, that if half the Diameter required be greater than any in the Table, in that Cafe you may take $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$, *&c.* and proceed as before directed.

The Defcription and Ufe of a new invented infpectional plane Scale, *for finding the exact Diameter, in Proportion to any limited Height of* Columns and Pilafters.

Plate XXXIX. In the upper Part there is a Scale of 26 Feet, and at the Beginning thereof one of thofe Feet or Diameters, is divided into 12 equal Parts, called Inches. The 26 Feet are each divided into 4 equal Parts; and every one of thofe Divifions reprefents one Quarter of a Foot.

The Scale for finding the Diameter to any limitted Height, is the Angles ABC, ABD, ABE, ABF, and ABG.

The Perpendiculars that crofs the Angles fhew which outlines reprefent the *Tufcan, Doric, Ionic, Compofite,* and *Corinthian* Orders, and the Divifions on thefe Perpendiculars mark'd RLK, fhew how to find the Diameter for erecting a Column alone, the Column and its Entablature; the Column, Entablature and Pedeftal, or the Column and Pedeftal only: And which of thefe Divifions reprefents each of thefe in particular, is fufficiently explained in the Plate. As an Example.

Suppofe you wou'd know the Diameter for erecting the *Doric* Column with its Entablature, to a limited Height of 18 Feet $7\frac{1}{2}$ Inches.

Apply a Square to one fide of the Scale, as fuppofe the Side MN, move the Square backward and forward until the Side of which is right over 18 Feet, $7\frac{1}{2}$ Inches; then from the Line AE, to the Line ID (which is the Line for the *Doric* Order) draw the Line *a e.* Secondly, take a Ruler, and lay it from the Point A, over the firft Divifion on the *Doric* perpendicular Line, as at R, and

make

make a Mark by the Side of the Rular, just over the Perpendicular *a e*, as at *f*. then is *e f* a proportional Diameter to the limited Height, as was required. If you take the Distance *e f* between your Compasses, and apply them to the Beginning of the upper Scale of Feet and Inches, it will shew you the Diameter in Feet and Inches, which in this Example is 1 Foot 10$\frac{1}{2}$ Inches.

How by Arithmetical Calculation, to find the Module, or exact Diameter, in proportion to any limited Height of Colums, or Pilasters; according to any of the five Orders in Architecture, and in all the various Cases that can possibly occur in Practice, by the Proportions exhibited in the following Table, which are deducible from the Measures laid down in Plate XXXVIII.

		Mo.	Min.		F.	In.	
The *Tuscan.*	Column alone,	7	00	or	7	0	in Height.
	Column, and Entablature,	8	45		8	9	
	Column, Pedestal, and Entablature,	10	45		10	9	
	Column, and Pedestal,	9	00		9	0	
The *Doric.*	Column alone,	8	00	or	8	0	in Height.
	Column, and Entablature,	10	00		10	0	
	Column, Pedestal, and Entablature,	12	20		12	4	
	Column, and Pedestal,	10	20		10	4	
The *Ionic.*	Column alone,	9	00	or	9	0	in Height.
	Column, and Entablature,	10	48		10	9$\frac{4}{5}$	
	Column, Pedestal, and Entablature,	13	31		13	6$\frac{1}{5}$	
	Column, and Pedestal,	11	43		11	8$\frac{3}{5}$	
The *Composite.*	Column alone,	9	30	or	9	6	in Height.
	Column, and Entablature,	11	24		11	4$\frac{3}{4}$	
	Column, Pedestal, and Entablature,	14	12		14	3$\frac{3}{8}$	
	Column, and Pedestal,	12	18		12	3$\frac{1}{8}$	
The *Corinthian.*	Column alone,	10	00	or	10	0	in Height.
	Column, and Entablature,	12	00		12	0	
	Column, Pedestal, and Entablature,	15	00		15	0	
	Column, and Pedestal,	13	00		13	0	

The Use of the Table in finding the exact Module or Diameter, in Proportion to any Height of Columns, or Pilasters, is thus.

Suppose you want to know the Module, or Diameter for erecting the *Doric* Column, and Entablature to a limitted Height of 15 Feet, 3 Inches.

Seek in the Table of *Doric*, Column and Entablature, and right against it, you will find 10 Modules, or 10 Feet in Height, which is equal to 10 Modules, accounting every Module to be 1 Foot.

Now to find a Module in Proportion to the proposed Height, *viz.* 15 Feet, 3 Inches. Say by the Rule of Three Direct, if 10 Feet (*Note*, you may always reject the Fractional Part of an Inch in the Height, if any) in Height, require a Module of 12 Inches, what will 15 Feet, 3 Inches require?

Now as the first and third Numbers do each consist of two Denominations, *viz.* Feet and Inches, you must therefore always observe; first, to reduce each Number into the lowest Denomination, that is Inches; and observe also, that the first and third Numbers, are both of one Denomination, that is, both Feet, or both Inches, which is done by multiplying the Feet by 12, and adding the Inches to the Product.

So 10 Feet multiplied by 12, the Product is 120 for the first Number in the Rule of Three Direct; also 15 Feet multiplied by 12; and adding thereto 3 Inches, the Product shall be 183 Inches for the third Number, which if you multiply by 12 the middle Number, the Product shall be 2196; which if you Divide by your first Number, *viz.* 120, the Quotient shall give 18 Inches; there remains still 36, which you must multiply by 16, and the Product divided by 120, the Quotient shall be 4; whose Value is $\frac{4}{16}$ or $\frac{1}{4}$ of an Inch: So it appears from the foregoing Directions, that the Diameter sought, is 18 $\frac{4}{16}$ Inches; and the same Rule is to be observed in finding a Module to any of the other Orders, in any of the Cases, or to any Height whatsoever.

The Explanation of an inspectional plain Scale, *for reducing* Modules *and* Minutes, *to* Feet *and* Inches, Plate XXXVI.

The lower Scale A B, is a Scale of 2 Feet, or 24 Inches, divided in $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$ Inch, and is the Scale by which the Modules are reduced to Feet and Inches, the other Scales marked on the Sides with 6, 7, 8, *&c.* to 24, are so many Modules divided into 60 equal Parts or Minutes, and are equal to 6, 7, 8 Inches, *&c.* of the lower Scale; the Scales between those marked with 6, 7, 8, *&c.* represent Modules of 6$\frac{1}{4}$, 6$\frac{1}{2}$, 6$\frac{3}{4}$; and the same is to be understood of any of the other Scales between 7, 8, 9, and 10, *&c.* As an Example.

Suppose the Module to be reduced to Inches be 12 Inches, and it be required to know how many Inches there are in 45 Minutes. First, seek the Module of 12 Inches in the Side A C, then take the Distance from 12 to 45 Minutes in your Compasses, that extent will reach on the lower Scale A B to 9 Inches.

Again, take to 15 Minutes, and you will find it to reach to 3 Inches, the same Rule is to be observed in reducing any other Module.

An Explanation of an Inspectional Table, shewing the Value of one Foot in Length of Oak, or any other Timber that is squared, and cut to any Scantling or Size, fit for Building at the Rate of 2 *s.* or any other Price per Foot, cubical Measure. See Plate XXXVII.

In the first Column towards the Left-hand, you have the Scantling or Size of one Side of the Piece, and the Scantling or Size of the other Side, upon the Top of all the other Columns: The Figures in every Column, but the first towards the Left-hand, shew the Price; those Figures under *s*, stand for Shillings, those under *d*, for Pence, and those under *p*, for so many $\frac{1}{8}$ths of a Penny. As an Example.

Suppose you wou'd know the Price of a Foot of Stuff, whose Sides are $7\frac{1}{2}$ by 6 Inches: Seek in the Left-hand Column of the Table for $7\frac{1}{2}$, and direct your Eye in a strait Line from thence until you are right under 6 Inches, the Scantling of the other Side, placed in the Top of the Column, and in the Angle of meeting, you will find set down 7 *d.* 4 *p*, which is 7 Pence and 4 Eights of a Penny the Price sought. The same Rule is to be observed in finding the Price to any other Scantling.

N. B. If you want to know the Price of a Foot of Stuff, whose Scantling is larger than any in the Table; seek the Price to $\frac{1}{2}$ that Scantling, and 4 Times that Sum is the Price sought.

Suppose the Scantling given is 20, by 16, the $\frac{1}{2}$ is 10 by 8, the Price of which is 1 *s.* 1 *d.* 2 *p.* the same 4 Times, is 4 *s.* 5 *d.* the Price required.

If your Price is 3 *d.* 4 *d.* or 6 *d.* per Foot, more than 2 *s.* add $\frac{1}{8}$, $\frac{1}{6}$, $\frac{1}{4}$. Example.

What is the Value of a Foot of Oak, or any other Timber 6 by 9 Inches, at 2 *s.* 3 *d.* per Foot, cubic Measure. First I find by the Table that the Value of 2 *s.* per Foot is 9 *d.* $\frac{1}{8}$ whereof is $1\frac{1}{8}$ *d.* which added to 9 *d.* makes 10 *d.* 1 *p.*

If less than 2 *s.* observe to deduct instead of adding. As an Example.

What is the Value of a Foot of Timber 6 Inches by 9 Inches, at 1 *s.* 8 *d.* per Foot cubic Measure. First, I find by the Table, that 2 *s.* per Foot, its Value is 9 *d.* $\frac{1}{6}$ of which $1\frac{1}{2}$ *d.* which deducted from 9 *d.* there remains $7\frac{1}{2}$ *d.* for the Value sought.

In Plate XL is exhibited a great Variety of Frets.

An inspectional Table shewing the Number of Feet and Parts cubic Measure in the Gross solid, contained in a Square of Flooring, laid with thorough Joists, and their proper Scantlings, at any Length from 6 to 52 Feet; the Plank to be $1\frac{1}{2}$ Inch thick, making proper Allowances for Waste in Sawing and Plaining.

F.	I.	P.	I.	P.	F.	P.	F.	I.	P.	I.	P.	F.	P.
6	6	75	1	6	21	74	30	12	75	4	2	50	77
8	7	25	1	8	24	40	32	13	25	4	4	54	92
10	7	75	2	0	25	14	34	13	75	4	6	57	65
12	8	25	2	2	27	08	36	14	25	4	8	61	16
14	8	75	2	4	29	15	38	14	75	5	0	64	84
16	9	25	2	6	31	37	40	15	25	5	2	68	79
18	9	75	2	8	33	72	42	15	75	5	4	72	72
20	10	25	3	0	36	22	44	16	25	5	6	76	97
22	10	75	3	2	38	85	46	16	75	5	8	81	27
24	11	25	3	4	41	62	48	17	25	6	0	85	7
26	11	75	3	6	44	54	50	17	75	6	2	90	28
28	12	25	3	8	47	58	52	18	25	6	4	94	8

EXPLANATION.

In the 1st. and 5th. Columns, are the Lengths of the Joists in Full, in the 2d. and 6th. their Depth, in Inches and Parts; in the 3d. and 7th. their Thickness in Inches and Parts; and in the 4th. and 8th. Columns, the Number of Feet contained in a Square of Flooring, laid with Boards and Joists, according to any of said Bearings.

An inspectional Table shewing the Number of cubic Feet and Parts, in one Square of thorough Roofing, the Rafter being of any Length from 6 to 20 Feet, with the proper Scantling thereof.

F.	I.	P.	I.	P.	F.	P.
6	5	2	1	6	8	91
8	5	6	1	8	10	44
10	6	0	2	0	11	97
12	6	4	2	2	13	5
14	6	8	2	4	15	13
16	7	2	2	6	16	88
18	7	6	2	8	18	75
20	8	0	3	0	20	72

EXPLANATION.

In the 1st. Column under F. is the Length of the Rafter in Feet, in the 2d. the Depth in Inches and Parts taken in the Middle, in the 3d. the Thickness in Inches and Parts, and in the 4th. Column, the Cubic Feet in one Square thereof, making proper Allowances for Sawing, &c.

A TABLE

A TABLE for readily shewing the Tunnage of Timber, at any Girt, from 6 to 20 Inches square, and from 1 Foot, to 40 Feet in Length.

L.	I. Q.	I. Q.	I. Q.	I. Q.	I. Q.	I. Q.	I. Q.	I. Q.	I. Q.	I. Q.	I. Q.	I. Q.	I. Q.	I. Q.	I. Q.	I. Q.	I. Q.	I. Q.	I. Q.	I. Q.	I. Q.	I. Q.	I. Q.	I. Q.	I. Q.	I. Q.	I. Q.	I. Q.	I. Q.	I. Q.	I. Q.
F.	6 0	0 1	6 2	6 3	7 0	7 1	7 2	7 3	8 0	8 1	8 2	8 3	9 0	9 1	9 2	9 3	10 0	10 1	10 2	10 3	11 0	11 1	11 2	11 3	12 0	12 1	12 2	12 3	13 0	13 1	13 2
1	0 1	0 1	0 1	0 1	0 1	0 1	0 1	0 1	0 1	0 1	0 2	0 2	0 2	0 2	0 2	0 2	0 2	0 2	0 3	0 3	0 3	0 3	0 3	0 3	1 0	1 0	1 0	1 0	1 0	1 0	1 1
2	0 2	0 2	0 2	0 2	0 2	0 2	0 3	0 3	0 3	0 3	1 0	1 0	1 0	1 0	1 1	1 1	1 1	1 1	1 2	1 2	1 2	1 3	1 3	1 3	2 0	2 0	2 0	2 1	2 1	2 1	2 2
3	0 3	0 3	0 3	0 3	1 0	1 0	1 0	1 1	1 1	1 1	1 2	1 2	1 2	1 3	1 3	1 3	2 0	2 0	2 1	2 1	2 2	2 2	2 3	2 3	3 0	3 0	3 1	3 1	3 2	3 2	3 3
4	1 0	1 0	1 0	1 1	1 1	1 1	1 2	1 2	1 3	1 3	2 0	2 0	2 1	2 1	2 2	2 2	2 3	2 3	3 0	3 0	3 1	3 2	3 2	3 3	4 0	4 0	4 1	4 2	4 2	4 3	5 0
5	1 1	1 1	1 1	1 2	1 2	1 3	1 3	2 0	2 0	2 1	2 2	2 2	2 3	2 3	3 0	3 1	3 1	3 2	3 3	3 3	4 0	4 1	4 2	4 3	5 0	5 0	5 1	5 2	5 3	6 0	6 1
6	1 2	1 2	1 3	1 3	2 0	2 0	2 1	2 2	2 2	2 3	3 0	3 0	3 1	3 2	3 3	3 3	4 0	4 1	4 2	4 3	5 0	5 1	5 2	5 3	6 0	6 1	6 2	6 3	7 0	7 1	7 2
7	1 3	1 3	2 0	2 0	2 1	2 2	2 2	2 3	3 0	3 1	3 2	3 2	3 3	4 0	4 1	4 2	4 3	5 0	5 1	5 2	5 3	6 0	6 1	6 2	7 0	7 1	7 2	7 3	8 0	8 2	8 3
8	2 0	2 0	2 1	2 2	2 2	2 3	3 0	3 1	3 2	3 3	4 0	4 0	4 2	4 3	4 3	5 1	5 2	5 3	6 0	6 1	6 3	7 0	7 1	7 2	8 0	8 1	8 2	8 3	9 1	9 3	10 0
9	2 1	2 2	2 2	2 3	3 0	3 1	3 1	3 3	3 3	4 1	4 2	4 2	5 0	5 1	5 2	5 3	6 1	6 2	6 3	7 0	7 2	7 3	8 1	7 2	9 0	9 1	9 3	10 0	10 2	10 3	11 1
10	2 2	2 3	2 3	3 0	3 1	3 2	3 3	4 0	4 1	4 2	5 0	5 0	5 2	5 3	6 1	6 2	6 3	7 1	7 2	7 3	8 1	8 3	9 0	9 2	10 0	10 1	10 3	11 1	11 3	12 0	12 2
11	2 3	3 0	3 1	3 1	3 3	4 0	4 0	4 2	4 3	5 0	5 2	5 3	6 0	6 2	6 3	7 1	7 2	8 0	8 1	8 3	9 1	9 2	10 0	10 2	11 0	11 1	11 3	12 1	12 3	13 1	13 3
12	3 0	3 1	3 2	3 3	4 0	4 1	4 2	4 3	5 1	5 2	6 0	6 1	6 2	7 0	7 2	7 3	8 1	8 3	9 0	9 2	10 0	10 2	11 0	11 2	12 0	12 2	13 0	13 2	14 0	14 2	15 0
13	3 1	3 2	3 3	4 0	4 1	4 3	4 3	5 1	5 3	6 0	6 2	6 3	7 1	7 2	8 0	8 2	9 0	9 1	9 3	10 1	11 0	11 1	11 3	12 1	13 0	13 2	14 0	14 2	15 1	15 3	16 1
14	3 2	3 3	4 0	4 1	4 3	5 0	5 1	5 3	6 0	6 2	7 0	7 1	7 3	8 1	8 2	9 1	9 2	10 0	10 3	11 0	11 3	12 1	12 3	13 1	14 0	14 2	15 0	15 3	16 1	17 0	17 2
15	3 3	4 0	4 1	4 2	5 0	5 1	5 3	6 0	6 2	7 0	7 2	7 3	8 1	8 3	9 1	9 3	10 1	10 3	11 2	11 3	12 2	13 0	13 3	14 1	15 0	15 2	16 1	16 3	17 2	18 1	18 3
16	4 0	4 2	4 2	5 0	5 1	5 3	6 0	6 2	7 0	7 2	8 0	8 1	8 3	9 2	9 3	10 2	11 0	11 2	12 1	12 3	13 2	14 0	14 2	15 1	16 0	16 2	17 1	18 0	18 3	19 2	20 1
17	4 1	4 2	4 3	5 1	5 3	6 0	6 2	7 0	7 2	8 0	8 2	8 3	9 2	10 0	10 2	11 0	11 3	12 1	13 0	13 2	14 1	14 3	15 2	16 1	17 0	17 2	18 1	19 0	19 3	20 2	21 2
18	4 2	4 3	5 1	5 2	6 0	6 2	6 3	7 1	7 3	8 2	9 0	9 1	10 0	10 2	11 1	11 3	12 1	13 0	13 2	14 1	15 1	15 3	16 2	17 1	18 0	18 2	19 2	20 1	21 0	21 3	22 3
19	4 3	5 1	5 2	5 3	6 1	6 3	7 1	7 3	8 1	8 3	9 2	9 3	10 2	11 1	11 3	12 2	13 0	13 3	14 2	15 0	16 0	16 2	17 1	18 0	19 0	19 3	20 2	21 1	22 1	23 0	24 0
20	5 0	5 2	5 3	6 1	6 3	7 1	7 2	8 1	8 3	9 1	10 0	10 1	11 1	11 3	12 2	13 0	13 3	14 2	15 1	15 3	16 3	17 2	18 1	19 0	20 0	20 0	21 2	22 2	23 1	24 1	25 1
21	5 1	5 3	6 0	6 2	7 0	7 2	8 0	8 2	9 1	9 3	10 2	11 0	11 3	12 2	13 0	13 3	14 2	15 1	16 0	16 2	17 3	18 1	19 1	20 0	21 0	21 0	22 3	23 2	24 2	25 2	26 2
22	5 2	6 0	6 1	6 3	7 1	8 0	8 1	9 0	9 3	10 1	11 0	11 2	12 1	13 0	13 2	14 2	15 1	16 0	16 3	17 2	18 2	19 1	20 0	21 0	22 0	22 3	23 3	24 3	25 3	26 3	27 3
23	5 3	6 1	6 3	7 1	7 3	8 1	8 3	9 2	10 0	10 3	11 2	12 0	12 3	13 2	14 1	15 0	15 3	16 3	17 2	18 1	19 2	20 2	21 0	22 0	23 0	23 3	24 3	25 3	26 3	28 0	29 0
24	6 0	6 2	7 0	7 2	8 0	8 3	9 1	9 3	10 2	11 1	12 0	12 2	13 2	14 1	14 3	15 3	16 2	17 2	18 1	19 0	20 1	21 2	22 0	23 0	24 0	25 0	26 0	27 0	28 0	29 1	30 1
25	6 1	6 3	7 1	7 3	8 2	9 0	9 2	10 1	11 0	11 3	12 2	13 0	14 0	14 3	15 2	16 2	17 1	18 1	19 0	19 3	21 0	21 3	22 3	23 3	25 0	26 0	27 0	28 0	29 1	30 2	31 2
26	6 2	7 0	7 2	8 0	8 3	9 2	9 3	10 3	11 2	12 1	13 0	13 2	14 2	15 1	16 0	17 0	18 0	18 3	19 3	20 2	21 3	22 3	23 3	24 3	26 0	27 0	28 0	29 1	30 2	31 2	32 3
27	6 3	7 1	7 3	8 2	9 0	9 3	10 1	11 0	12 0	12 3	13 2	14 0	15 0	16 0	16 3	17 3	18 3	19 2	20 2	21 1	22 3	23 3	24 3	25 3	27 0	28 0	29 1	30 1	31 2	32 3	34 0
28	7 0	7 2	8 0	8 3	9 2	10 0	10 2	11 2	12 1	13 0	14 0	14 2	15 3	16 2	17 1	18 2	19 1	20 1	21 1	22 1	23 2	24 2	25 2	26 3	28 0	29 0	30 1	31 2	32 3	34 0	35 1
29	7 1	7 3	8 2	9 0	9 3	10 2	11 0	12 0	12 3	13 2	14 2	15 0	16 1	17 1	18 0	19 0	20 0	21 0	22 0	23 0	24 2	25 2	26 2	27 2	29 0	30 0	31 1	32 2	34 0	35 1	36 2
30	7 2	8 1	8 3	9 1	10 0	10 3	11 2	12 1	13 1	14 0	15 0	15 2	16 3	17 3	18 2	19 3	20 3	21 3	22 3	23 3	25 1	26 1	27 2	28 2	30 0	31 1	32 2	33 3	35 0	36 2	37 3
31	7 3	8 2	9 0	9 3	10 2	11 1	11 3	12 3	13 3	14 2	15 2	16 1	17 1	18 1	19 1	20 1	21 2	22 2	23 3	24 2	26 1	27 1	28 1	29 2	31 0	32 1	33 2	34 3	36 1	37 3	39 0
32	8 0	8 3	9 1	10 0	10 3	11 2	12 1	13 1	14 0	15 0	16 0	16 3	18 0	19 0	19 3	21 0	22 1	23 1	24 2	25 1	27 0	28 0	29 1	30 2	32 0	33 1	34 2	36 0	37 2	39 0	40 1
33	8 1	9 0	9 2	10 1	11 0	12 0	12 2	13 3	14 2	15 2	16 2	17 1	18 2	19 2	20 2	21 3	22 3	24 0	25 1	26 0	27 3	29 0	30 1	31 2	33 0	34 1	35 3	37 0	38 2	40 0	41 3
34	8 2	9 1	9 3	10 3	11 2	12 1	13 0	14 0	15 0	16 0	17 0	17 3	19 0	20 0	21 1	22 1	23 2	24 3	26 0	27 0	28 3	29 3	31 0	32 2	34 0	35 1	36 3	38 1	39 3	41 1	43 0
35	8 3	9 2	10 1	11 0	11 3	12 3	13 1	14 1	15 2	16 2	17 2	18 1	19 2	20 3	21 3	23 0	24 1	25 2	26 3	27 3	29 2	30 3	32 0	33 1	35 0	36 2	37 3	39 1	41 0	42 2	44 1
36	9 0	9 3	10 2	11 1	12 1	13 0	13 3	15 0	15 3	16 3	18 0	18 3	20 1	21 1	22 1	23 3	24 3	26 1	27 2	28 2	30 2	31 2	33 0	34 1	36 0	37 2	39 0	40 2	42 1	43 3	45 2
37	9 1	10 0	10 3	11 2	12 2	13 2	14 0	15 1	16 1	17 1	18 2	19 1	20 3	21 3	23 0	24 1	25 2	26 3	28 1	29 1	31 1	32 2	33 3	35 1	37 0	38 2	40 0	41 3	43 1	45 0	46 3
38	9 2	10 1	11 0	12 0	12 3	13 3	14 2	15 3	16 3	17 3	19 0	19 3	21 1	22 2	23 3	25 0	26 1	27 2	29 0	30 0	32 0	33 1	34 3	36 0	38 0	39 2	41 0	42 3	44 2	46 1	48 0
39	9 3	10 2	11 1	12 1	13 1	14 0	14 3	16 1	17 1	18 1	19 2	20 1	21 3	23 0	24 1	25 3	27 0	28 2	29 3	31 0	33 0	34 1	35 2	37 0	39 0	40 2	42 1	44 0	45 3	47 2	49 1
40	10 0	11 0	11 2	12 2	13 2	14 2	15 1	16 2	17 3	18 3	20 0	20 3	22 2	23 3	24 3	26 1	27 2	29 0	30 2	31 3	33 3	35 0	36 2	38 1	40 0	41 2	43 1	45 0	46 3	48 3	50 2

EXPLINATION.

In the first Column on the left Hand, is the Length from 1 to 40 Feet, in the other Column are Inches and Quarters, mark'd over Head with I. for Inches, and Q. for Quarters. Now suppose you want to know the Tunnage of a Piece of Timber whose Square is 9½ Inches, and Length 28 Feet; look in the Line of 28, and under 9¾ at Top, in the Angle of meeting, you shall find 18 Feet, 2 Quarters for the Tunnage required. The Thing is so plain it needs no further Explanation.

A TABLE, &c.

L. F.	I. Q. 13 3	I. Q. 14 0	I. Q. 14 1	I. Q. 14 2	I. Q. 14 3	I. Q. 15 0	I. Q. 15 1
1	1 1	1 1	1 1	1 1	1 2	1 2	1 2
2	2 2	2 1	2 3	2 3	3 0	3 0	3 1
3	3 3	4 0	4 1	4 1	4 2	4 2	4 3
4	5 1	5 1	5 2	5 3	6 0	6 1	6 1
5	6 2	6 3	7 0	7 1	7 2	7 3	8 0
6	7 3	8 0	8 1	8 3	9 0	9 1	9 2
7	9 0	9 2	9 3	10 0	10 2	10 3	11 1
8	10 2	10 3	11 1	11 2	12 0	12 2	12 3
9	11 3	12 1	12 2	13 0	13 2	14 2	14 3
10	13 0	13 2	14 0	14 2	15 0	15 2	16 1
11	14 1	14 3	15 2	16 0	16 2	17 0	17 3
12	15 3	16 1	16 3	17 2	18 0	18 1	19 1
13	17 0	17 2	18 1	18 3	19 2	20 1	20 3
14	18 1	19 0	19 3	20 1	21 0	21 3	22 2
15	19 2	20 1	21 0	21 3	22 2	23 1	24 0
16	20 3	21 3	22 2	23 1	24 0	24 3	25 3
17	22 1	23 0	23 3	24 3	25 2	26 2	27 1
18	23 2	24 2	25 1	26 1	27 0	28 0	29 0
19	24 3	25 3	26 3	27 3	28 2	29 2	30 2
20	26 1	27 0	28 0	29 0	30 0	31 1	32 1
21	27 2	28 2	29 2	30 2	31 2	32 3	33 3
22	28 3	29 3	31 0	32 0	33 0	34 1	35 2
23	30 0	31 1	32 1	33 2	34 2	35 3	37 0
24	31 1	32 2	33 3	35 0	36 0	37 2	38 3
25	32 3	34 0	35 1	36 2	37 3	39 0	40 1
26	34 0	35 1	36 2	37 3	39 1	40 2	41 3
27	35 1	36 3	38 0	39 1	40 3	42 1	43 2
28	36 3	38 0	39 2	40 3	42 1	43 2	45 0
29	38 0	39 1	40 3	42 1	43 3	45 1	46 3
30	39 1	40 3	42 1	43 3	45 1	46 3	48 1
31	40 2	42 0	43 2	45 1	46 3	48 1	50 3
32	41 3	43 2	45 0	46 2	48 1	49 3	51 2
33	43 1	44 3	46 2	48 0	49 3	51 5	53 1
34	44 2	46 1	47 3	49 2	51 1	53 0	54 3
35	45 3	47 2	49 1	51 0	52 3	54 2	56 2
36	47 1	48 3	50 3	52 2	54 1	56 0	58 1
37	48 2	50 1	52 0	53 3	55 3	57 2	59 0
38	49 3	51 2	53 2	55 1	57 1	59 1	61 3
39	51 0	53 0	54 3	56 3	58 3	60 3	63 0
40	52 1	54 1	56 1	[illegible] 1	60 1	62 0	64 0

L. F.	I. Q. 15 2	I. Q. 15 3	I. Q. 16 0	I. Q. 16 1	I. Q. 16 2	I. Q. 16 3	I. Q. 17 0
1	1 2	1 2	1 3	1 [illegible]	1 2	1 3	2 0
2	3 1	3 2	3 2	3 [illegible]	3 3	3 3	4 0
3	5 0	5 0	5 1	5 2	5 2	5 3	6 [illegible]
4	6 2	6 3	7 0	7 1	7 2	7 3	8 [illegible]
5	8 1	8 2	8 3	9 0	9 1	9 3	10 0
6	10 0	10 1	10 2	10 3	11 1	11 2	12 [illegible]
7	11 2	12 0	12 1	12 3	13 1	13 2	14 0
8	13 1	13 1	14 1	14 2	15 0	15 2	16 0
9	15 0	15 2	15 3	16 2	17 0	17 2	18 0
10	16 2	17 [illegible]	17 3	18 3	18 3	19 1	20 0
11	18 1	18 3	19 2	20 0	20 3	21 1	22 [illegible]
12	20 0	20 2	21 1	21 3	22 2	23 1	24 0
13	21 2	22 1	23 0	23 3	24 2	25 1	26 0
14	23 1	24 0	24 3	25 2	26 2	27 1	28 0
15	25 0	25 3	26 2	27 2	28 1	29 0	30 0
16	26 2	27 2	28 1	29 1	30 1	31 0	32 0
17	28 1	29 1	30 1	31 0	32 0	33 0	34 0
18	30 0	30 3	32 0	33 0	34 0	35 0	36 0
19	31 2	32 2	33 3	34 3	35 3	36 3	38 0
20	33 1	34 1	35 2	36 2	37 3	38 3	40 0
21	35 0	36 0	37 1	38 2	39 2	40 3	42 0
22	36 2	37 3	39 0	40 1	41 2	42 3	44 0
23	38 1	39 2	40 3	42	43 2	44 3	46 0
24	40 0	41 1	42 2	43 3	45 1	46 3	48 0
25	41 2	42 3	44 1	45 3	47 1	48 2	50 0
26	43 1	44 2	46 0	47 2	49 0	50 2	52 0
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32	53 1	54 3	56 3	58 2	60 2	62 1	64 0
33	55 1	56 2	58 2	60 2	62 1	64 1	66 0
34	56 4	58 1	60 1	62 1	64 1	66 1	68
35	58 3	59 3	62 0	64 0	66 0	68 0	70
36	60 0	61 2	63 3	65 3	68 0	70 0	72 [illegible]
37	61 2	63 1	64 [illegible]	67 3	69 3	72 0	74 [illegible]
38	63 1	65 0	66 2	69 [illegible]	71 3	74 0	76 [illegible]
39	65 0	65 3	68 1	71 2	73 2	75 3	68 1
40	66 2	68 2	[illegible] 2	73 1	75 2	77 3	80 1

L. F.	I. Q. 17 1	I. Q. 17 2	I. Q. 17 3	I. Q. 18 0	I. Q. 18 1	I. Q. 18 2	I. Q. 18 3
1	2 0	2 0	2 0	2 1	2 1	2 1	2 1
2	4 0	4 1	4 1	4 2	4 2	4 3	4 3
3	6 0	6 1	6 2	6 3	6 3	7 0	7 1
4	8 1	8 2	8 2	9 0	9 1	9 1	9 3
5	10 1	10 2	10 3	11 1	11 2	11 3	12 1
6	12 1	12 3	13 0	13 2	13 3	14 0	14 2
7	14 1	14 3	15 1	15 3	16 0	16 2	17 0
8	16 2	17 0	17 1	18 0	18 1	18 3	19 2
9	18 2	19 0	19 2	20 1	20 2	21 0	21 3
10	20 2	21 1	21 3	22 2	23 0	23 2	24 1
11	22 2	23 2	24 0	24 3	25 1	26 0	26 2
12	24 3	25 2	26 1	27 0	27 2	28 1	29 0
13	26 3	27 3	28 1	29 1	29 3	30 3	31 2
14	28 3	29 3	30 2	31 2	32 0	33 0	34 0
15	30 3	32 0	32 3	33 3	34 2	35 2	36 1
16	33 0	34 0	35 0	36 0	36 3	37 3	38 3
17	35 0	36 1	37 0	38 1	39 0	40 1	41 1
18	37 0	38 1	39 1	40 2	41 1	42 2	43 3
19	39 1	40 2	41 2	42 3	43 2	45 0	46 0
20	41 1	42 2	43 2	45 0	46 0	47 1	48 2
21	43 1	44 3	45 3	47 1	48 1	49 3	51 0
22	45 1	46 3	48 0	49 2	50 2	52 0	53 2
23	47 2	49 0	50 1	51 3	52 3	54 2	56 0
24	49 2	51 0	52 2	54 0	55 0	56 3	58 1
25	51 2	53 1	54 2	56 1	57 1	59 0	60 3
26	53 2	55 1	56 3	58 2	59 3	61 2	63 0
27	55 3	57 2	59 0	60 3	62 0	64 0	65 3
28	57 3	59 2	61 0	63 0	64 1	66 1	68 0
29	59 3	61 3	63 1	65 1	66 3	68 3	70 1
30	62 0	63 3	65 1	67 2	69 0	71 0	72 3
31	64 0	66 0	67 3	69 3	71 1	73 2	75 2
32	66 0	68 1	69 3	72 0	73 2	75 3	77 3
33	68 0	70 1	72 0	74 1	75 3	78 0	80 1
34	70 1	72 2	74 1	76 2	78 0	80 2	82 3
35	72 1	74 2	76 2	78 3	80 2	82 3	85 0
36	74 1	76 3	78 3	81 0	82 3	85 1	87 2
37	76 2	78 3	80 3	83 1	85 0	87 2	90 0
38	78 2	81 0	83 0	85 2	87 1	90 0	92 1
39	80 2	83 0	85 1	87 3	89 3	92 1	94 3
40	82 2	85 1	87 2	90 0	92 0	94 3	97 0

L. F.	I. Q. 19 0	I. Q. 19 1	I. Q. 19 2	I. Q. 19 3	I. Q. 20 0
1	2 2	2 2	2 2	2 2	2 3
2	5 0	5 0	5 1	5 2	5 2
3	7 2	7 2	7 3	8 0	8 1
4	10 0	10 1	10 2	10 3	11 1
5	12 2	12 3	13 0	13 2	13 3
6	15 0	15 1	15 3	16 0	16 2
7	17 2	17 3	18 1	18 3	19 1
8	20 0	20 1	21 0	21 2	22 0
9	22 2	23 0	23 3	24 1	24 3
10	25 0	25 2	26 1	27 0	27 2
11	27 2	28 1	29 0	29 2	30 1
12	30 0	30 3	31 2	32 1	33 0
13	32 2	33 1	34 1	35 0	35 3
14	35 0	36 0	36 3	37 3	38 3
15	37 2	38 2	39 2	41 0	41 2
16	40 0	41 0	41 2	43 1	44 1
17	42 2	43 2	44 3	45 3	47 0
18	45 0	46 0	47 1	48 2	49 3
19	47 2	48 3	50 0	51 1	52 2
20	50 0	51 1	52 3	54 0	55 1
21	52 2	53 3	55 2	56 2	58 0
22	55 0	56 2	58 0	59 1	60 1
23	57 2	59 0	59 3	62 0	63 0
24	60 0	61 2	63 1	65 3	65 3
25	62 2	64 1	66 0	68 2	68 2
26	65 0	66 3	68 2	70 2	71 1
27	67 2	69 2	71 0	72 3	74 0
28	70 0	72 0	73 3	75 2	76 3
29	72 2	74 2	76 2	78 1	79 2
30	75 0	77 0	79 0	81 0	82 2
31	77 2	79 2	81 3	83 2	85 1
32	80 0	82 1	84 1	86 1	88 0
33	82 2	84 3	87 0	89 0	90 3
34	85 0	87 1	89 3	91 3	93 2
35	87 2	89 0	92 1	94 2	96 1
36	90 0	92 2	95 0	97 0	99 0
37	92 2	95 0	97 2	99 3	101 3
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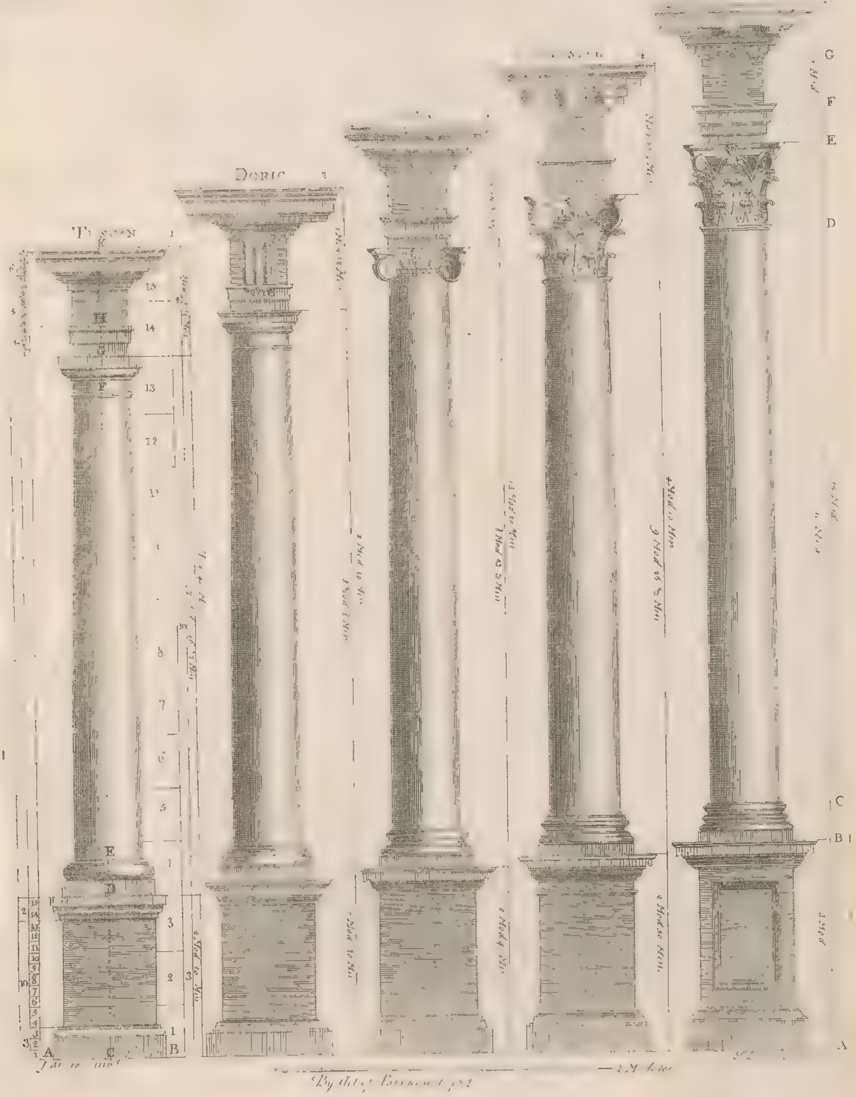
Plate I



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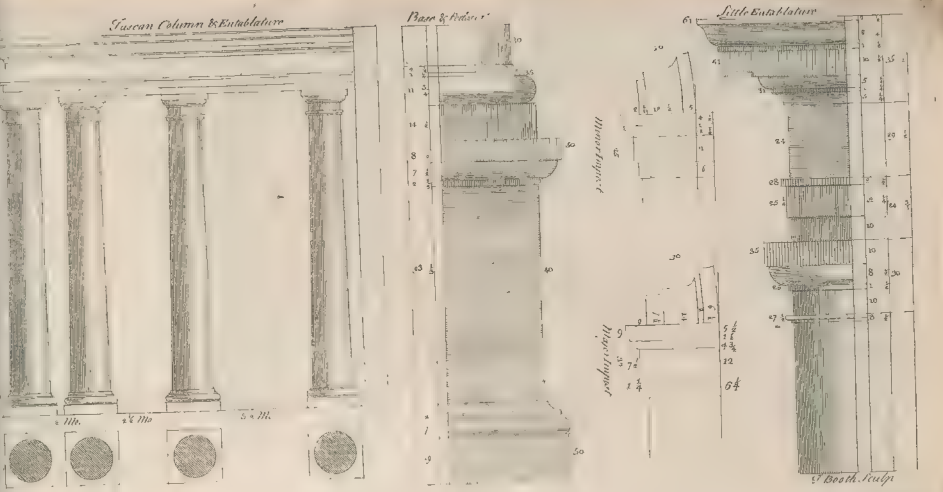
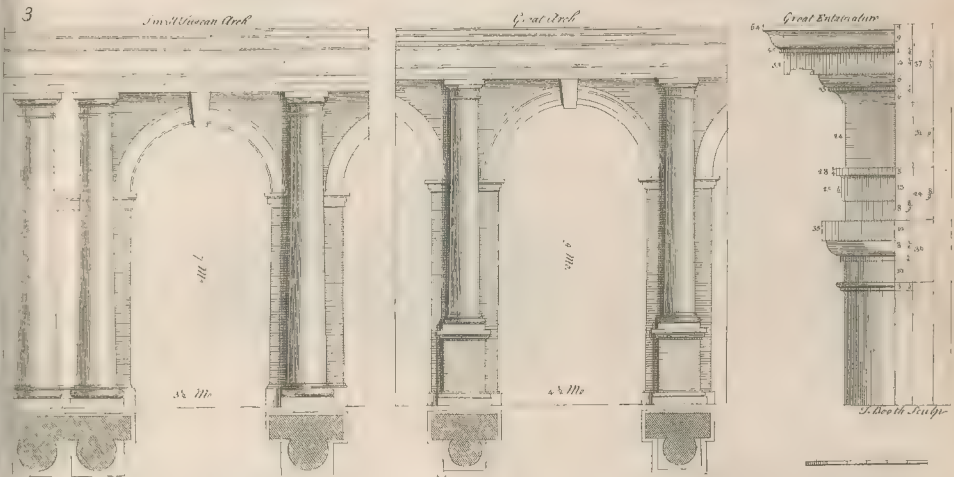
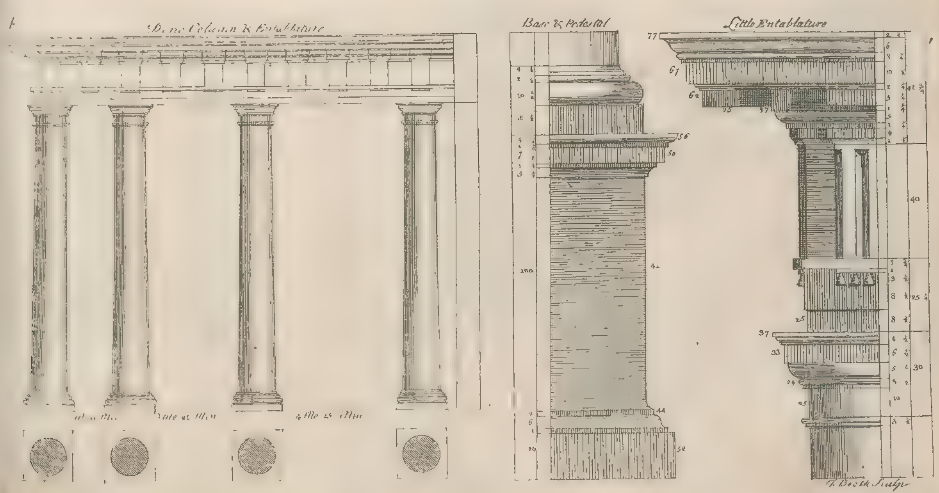

Tuscan Column & Entablature
Base & Pedestal
Little Entablature
Minor Impost
Major Impost
J. Booth Sculp

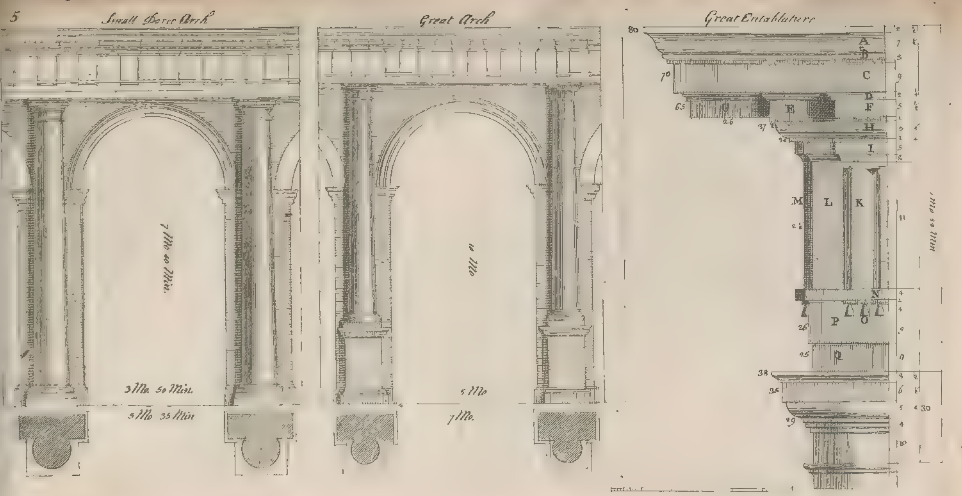
3

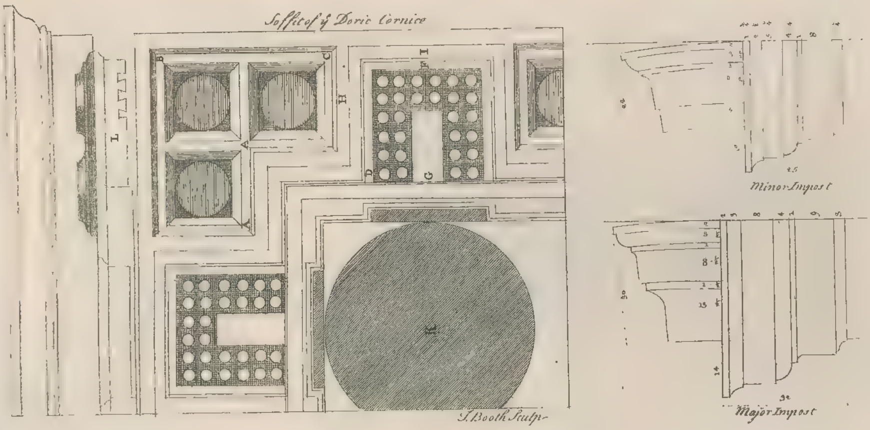

Small Tuscan Arch
Great Arch
Great Entablature
T. Booth Sculp

4


Doric Column & Entablature
Base & Pedestal
Little Entablature
J. Booth Sculp

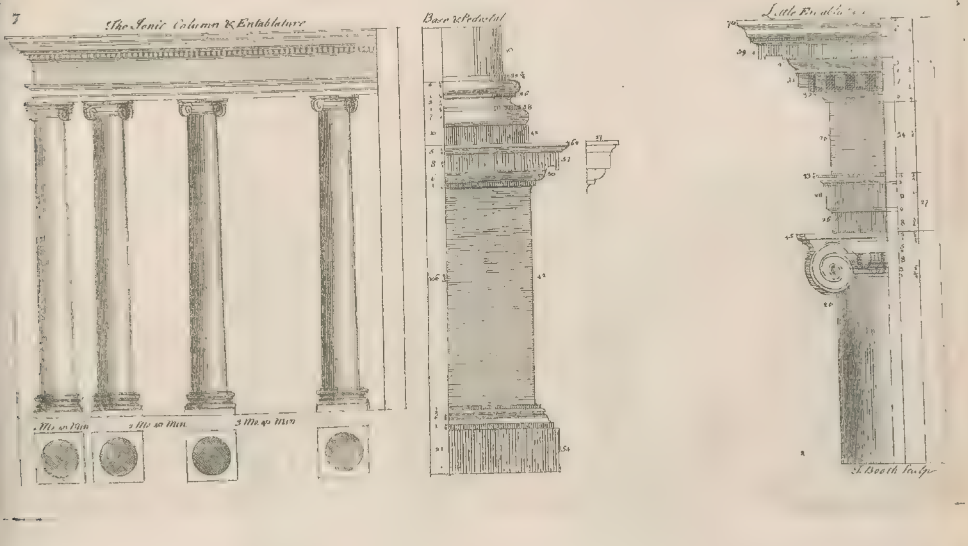
5

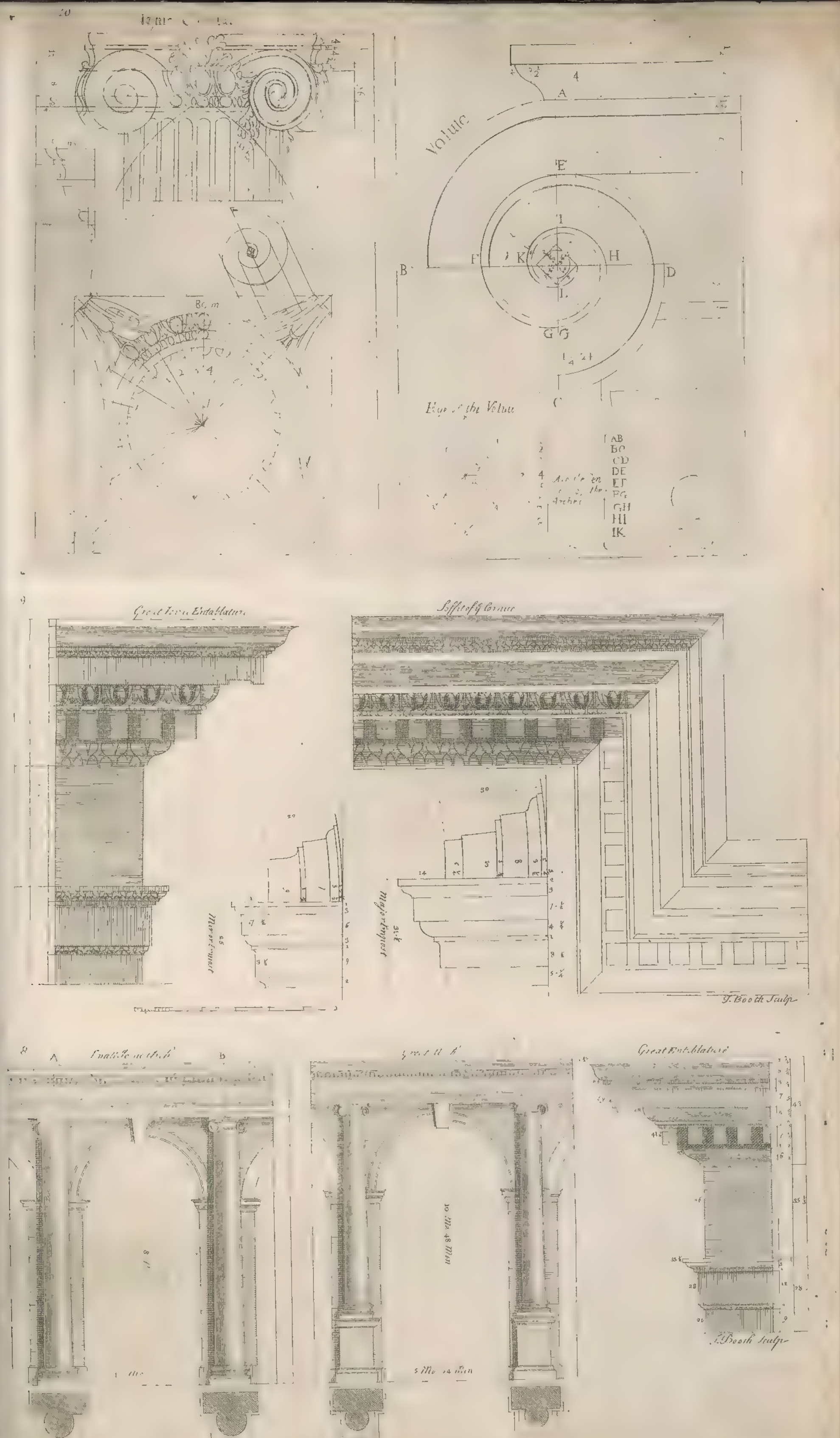

Small Doric Arch
Great Arch
Great Entablature
7 Mo 40 Min.
3 Mo. 50 Min.
5 Mo 35 Min
5 Mo
7 Mo.

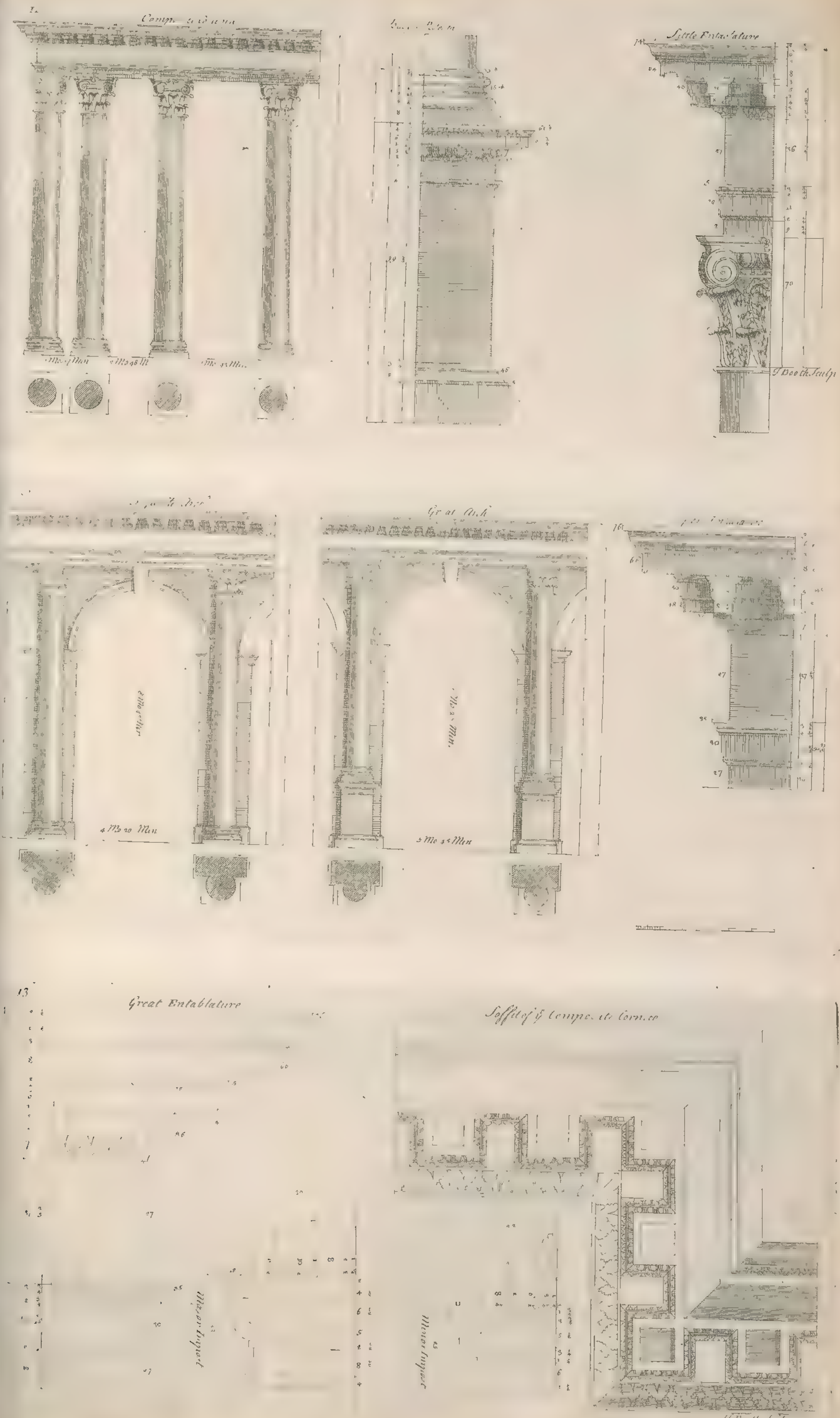

Soffit of ÿ Doric Cornice
Minor Impost
Major Impost
J. Booth Sculp

6

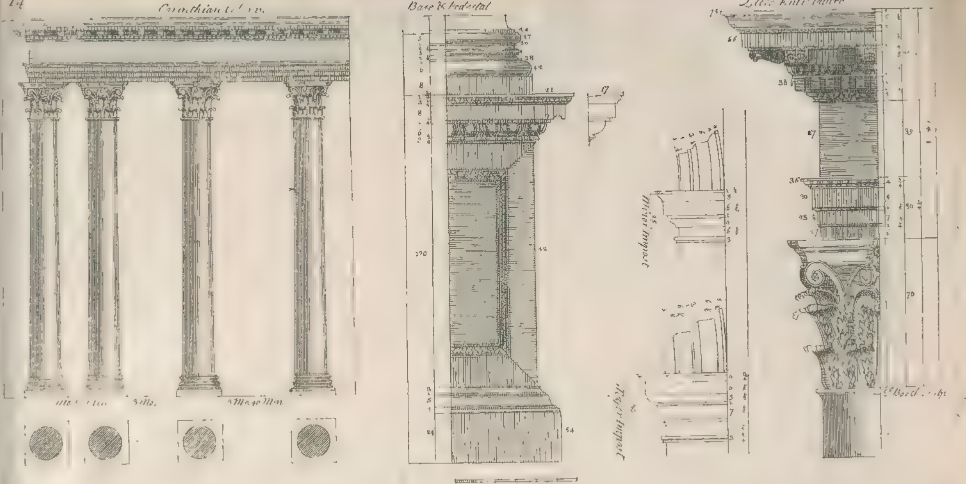
7


The Ionic Column & Entablature
Base & Pedestal
J. Booth Sculp

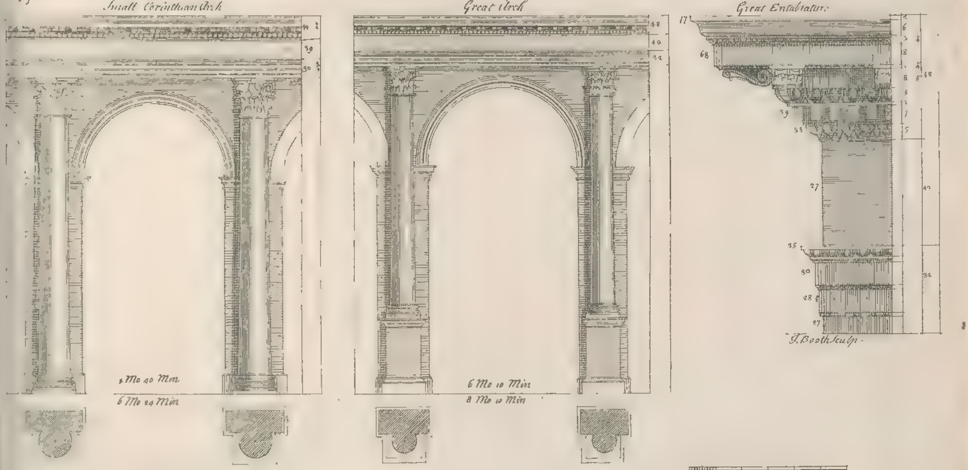

20
Volute
Eye of the Volute
Major Impost
Great Entablature
T. Booth Sculp


Little Entablature
T Booth Sculp
4 Mo 20 Min
3 Mo 25 Min
Great Entablature
T Booth Sculp

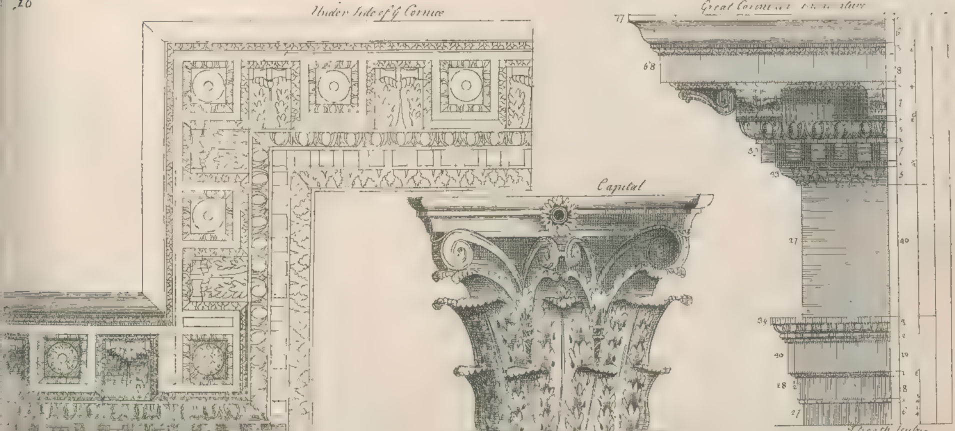
14


Base & Pedestal
Little Entablature
Minor Impost
Major Impost

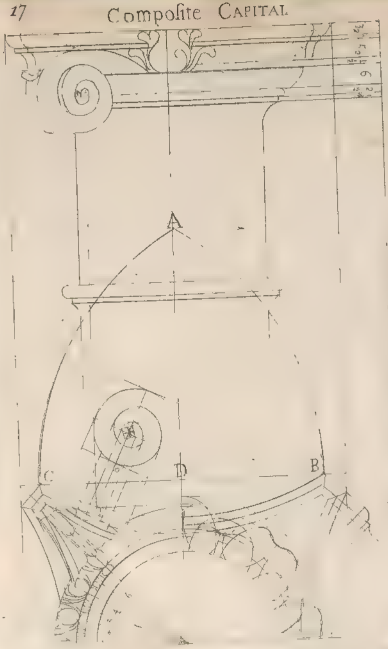
15

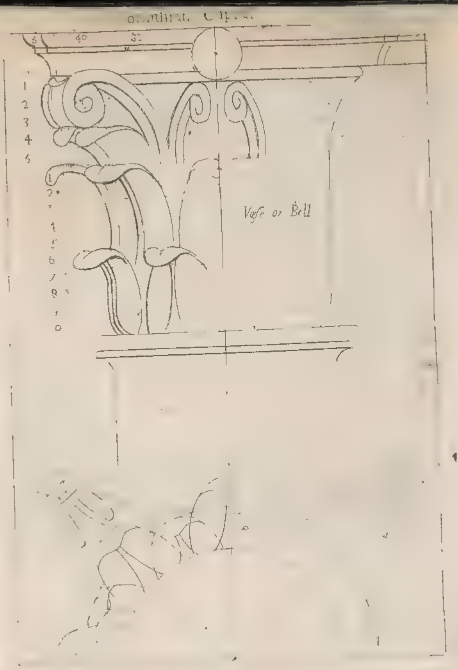

Small Corinthian Arch
Great Arch
Great Entablature
J. Booth Sculp.

16


Under Side of G. Cornice
Capital
J. Booth Sculp.

17 Composite CAPITAL





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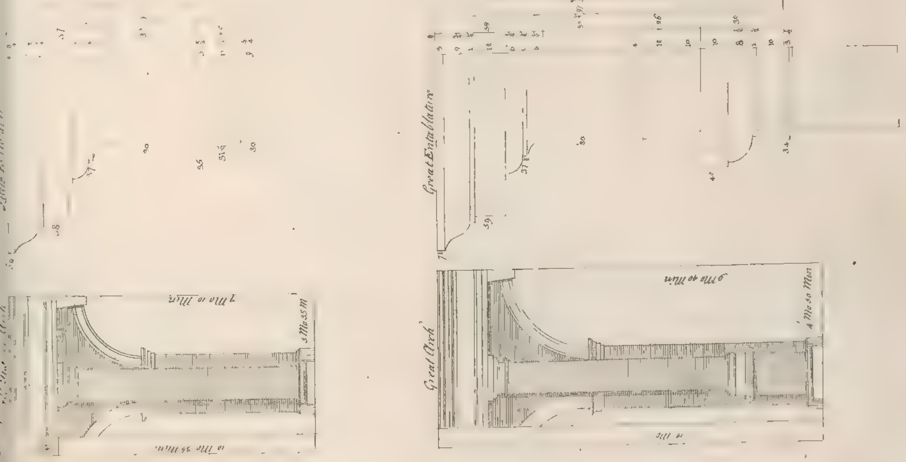
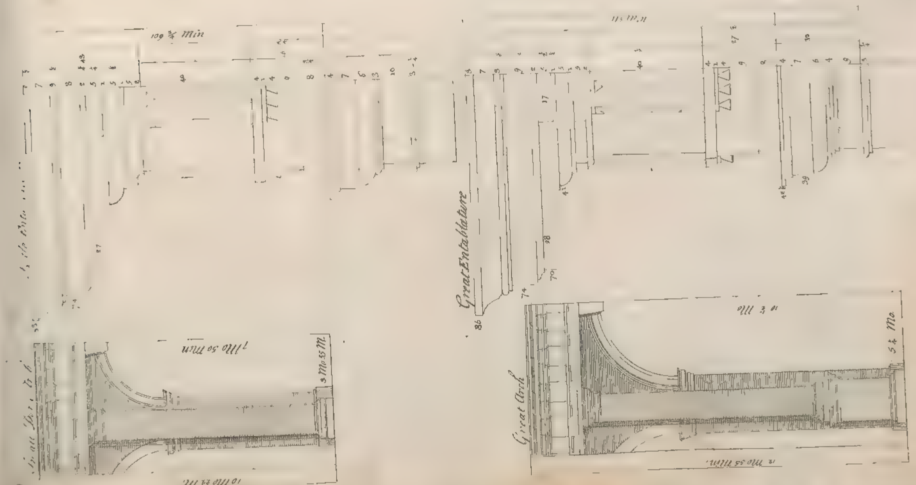
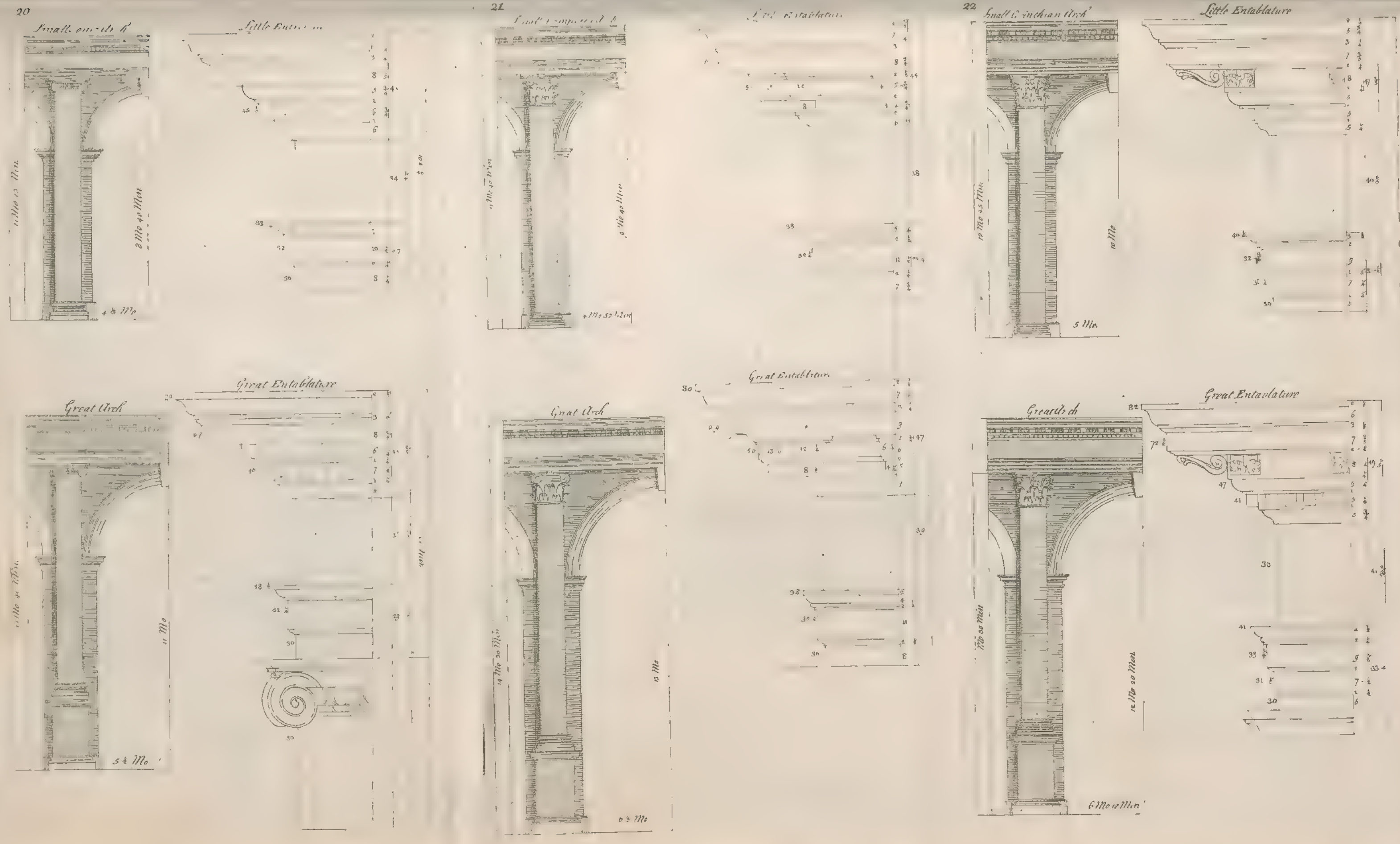


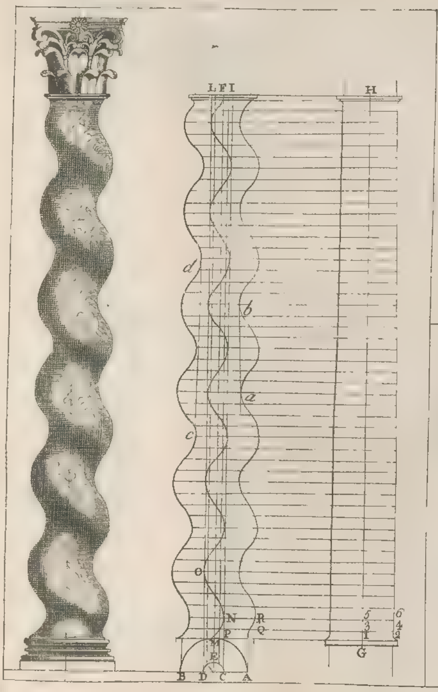
19




20
21
22
Great Arch
Great Entablature
Great Arch
Great Entablature
Little Entablature
Great Entavlature
5 ½ Mo
11 Mo
6 ½ Mo
13 Mo
5 Mo.
10 Mo
6 Mo 10 Min
12 Mo 20 Min

23

WAVED or TWISTED COLUMN.

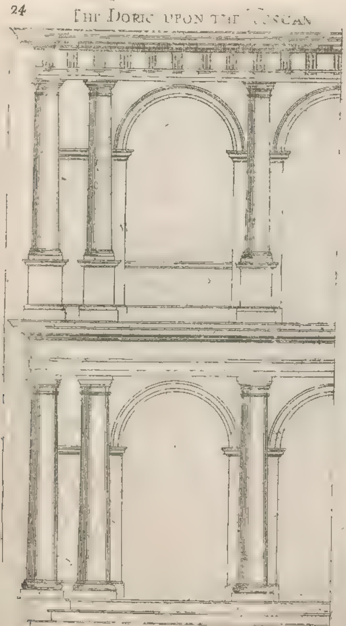


Caryatides

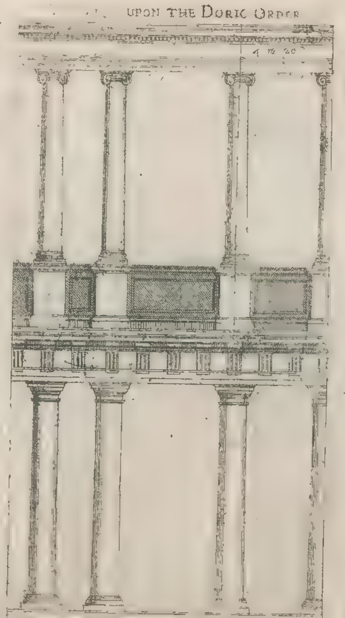
Persian

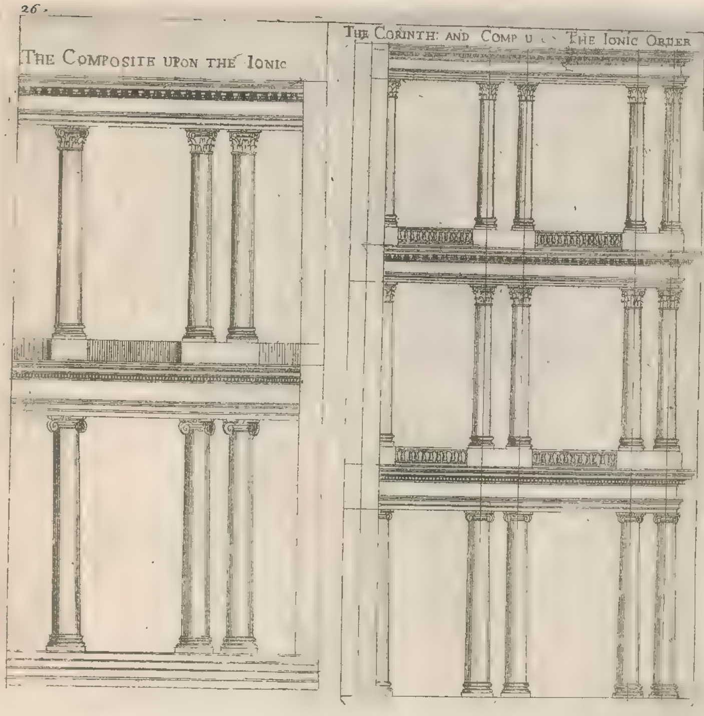
24

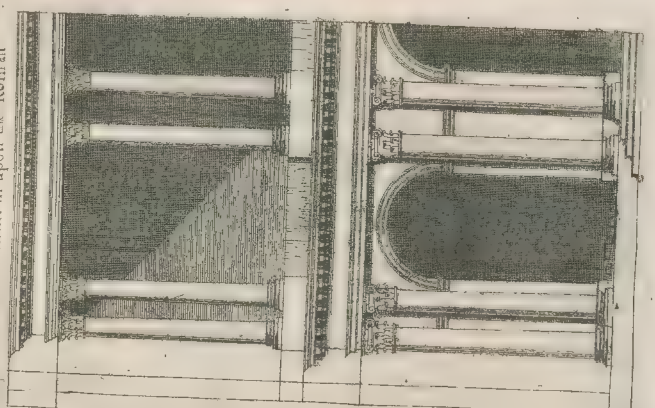
THE DORIC UPON THE TUSCAN



[illegible] UPON THE DORIC ORDER





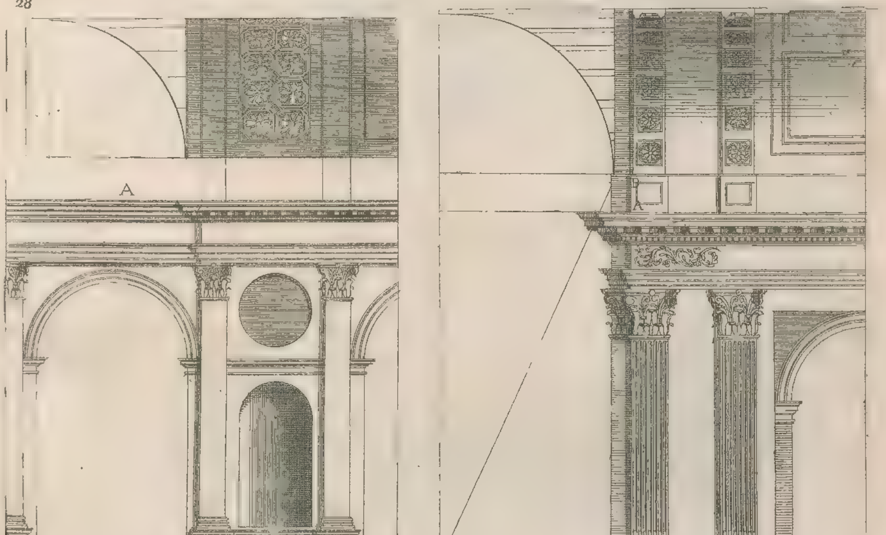


The Corinthian upon the Roman

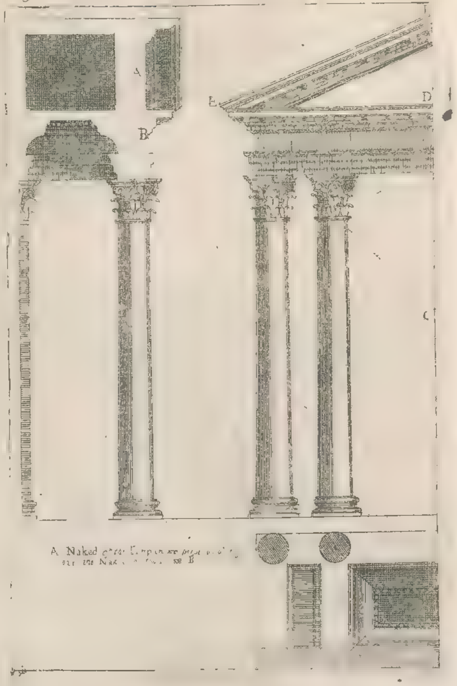
25

27

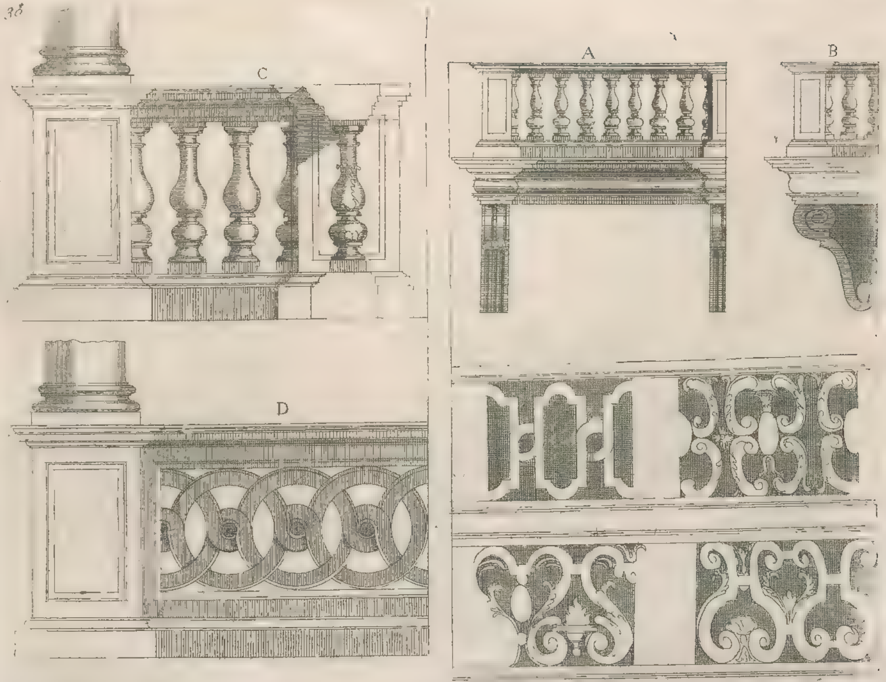
28



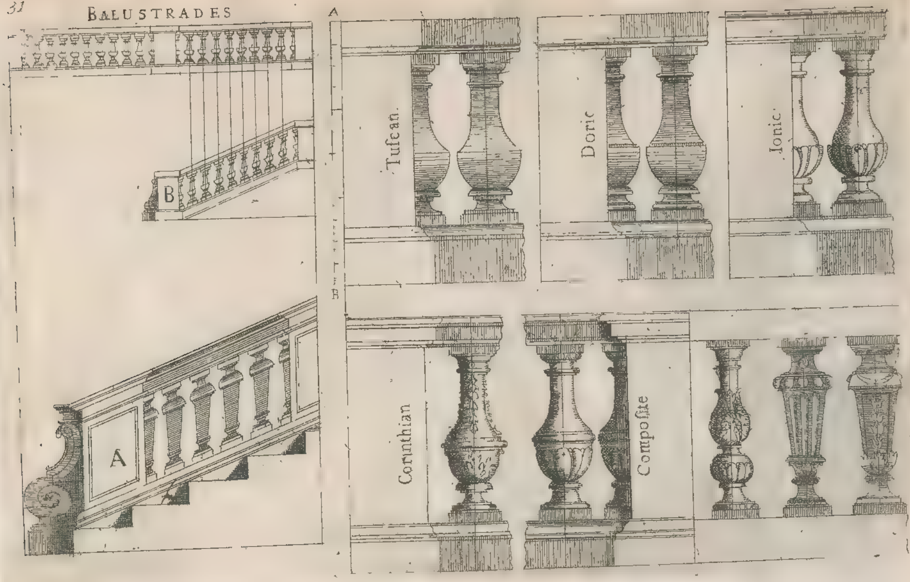
29



38



31 BALUSTRADES



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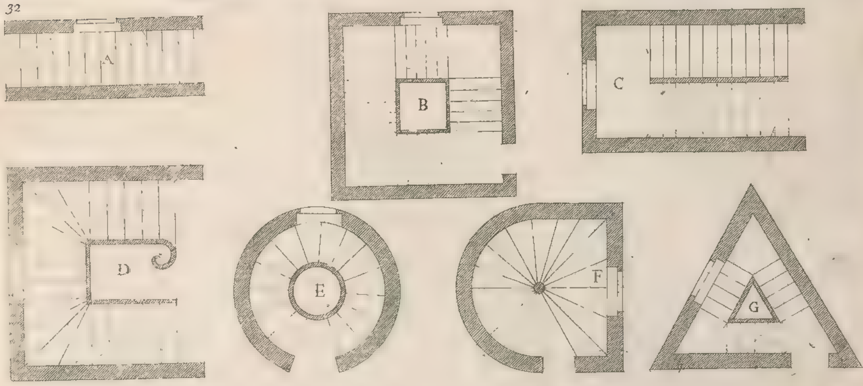

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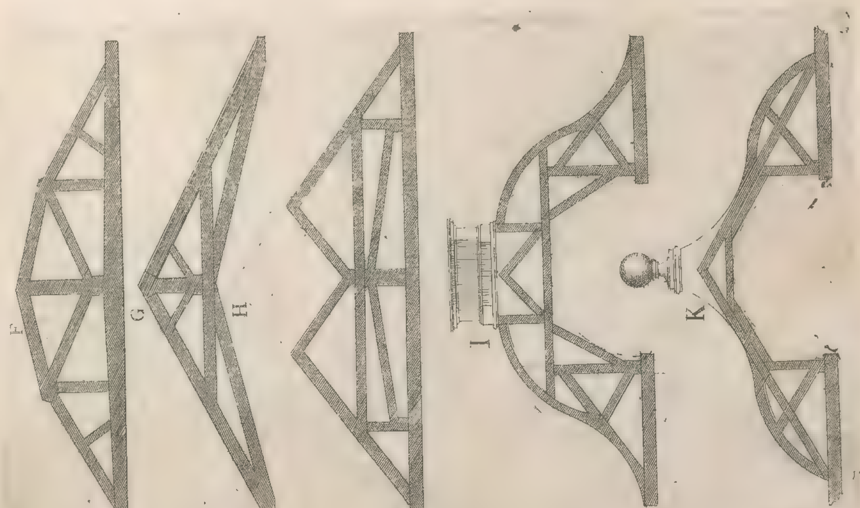
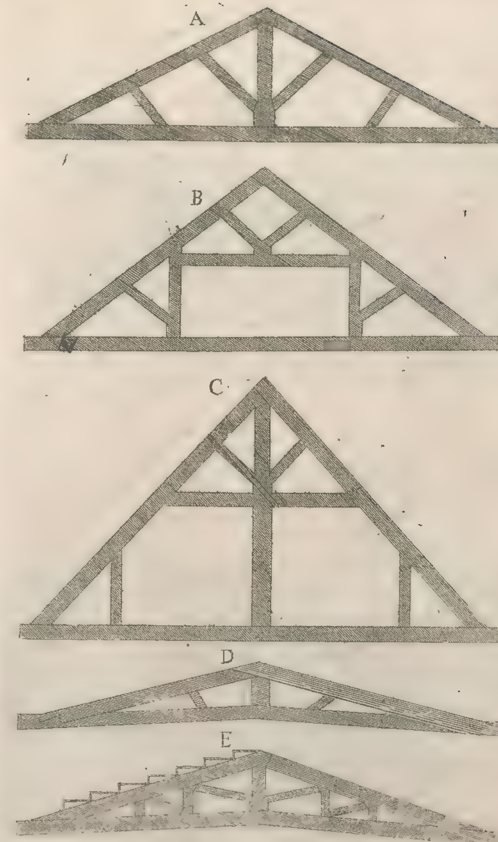
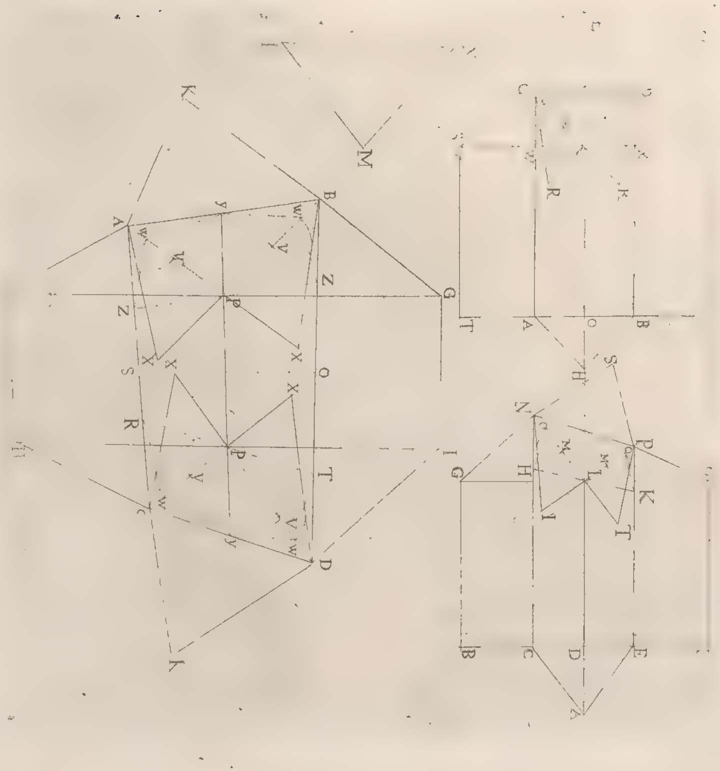
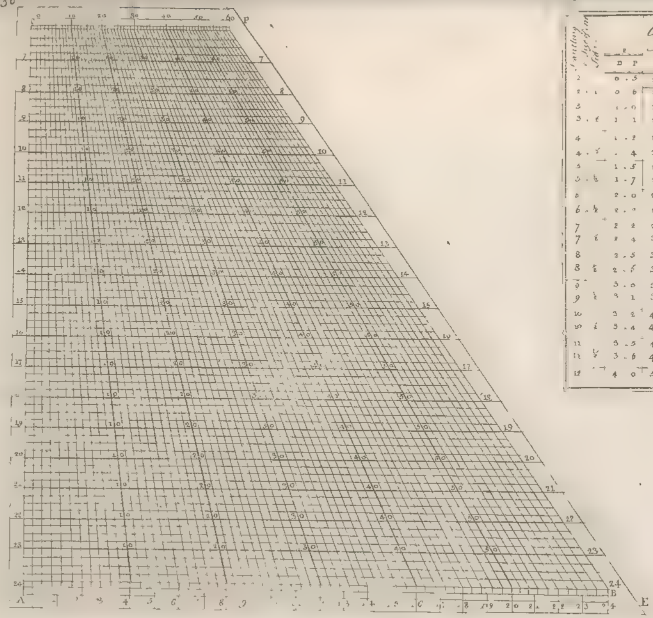


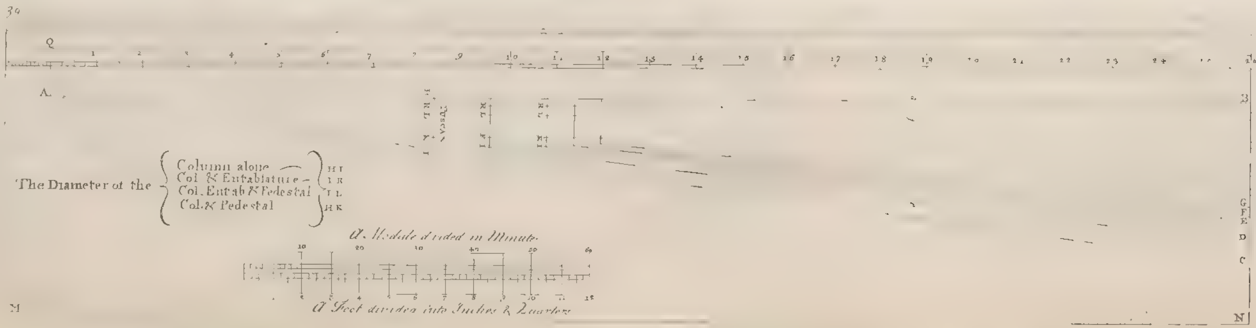

A
B
C
D
E





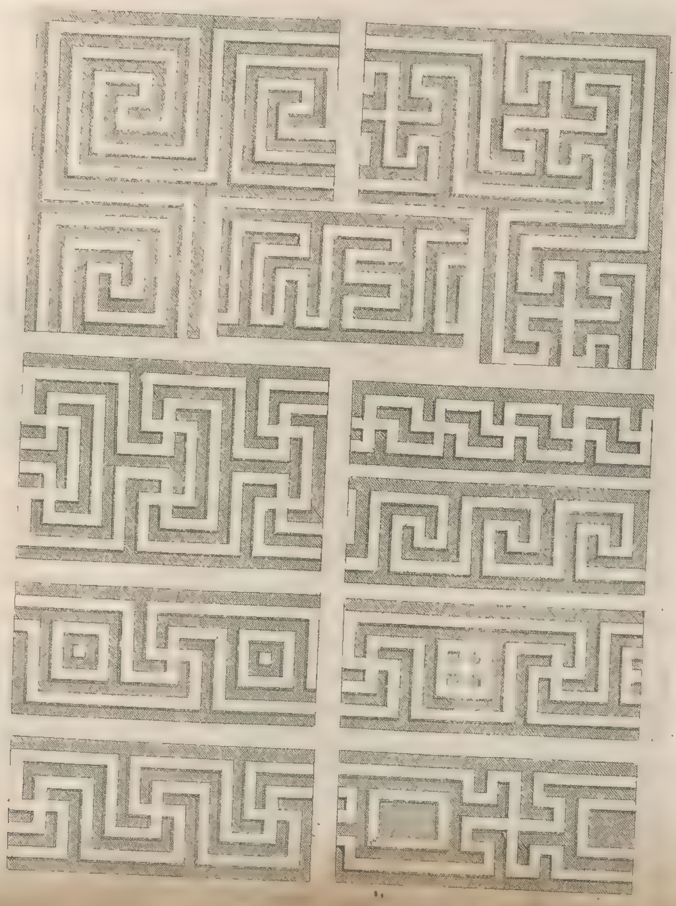
An INSPECTIONAL *Table Shewing the Value of one Foot in Length of Oak or any other Timber Squared Knt to any Scantling fit for Building, at y^e Rate of 2^d or any other Price per Foot*

Scantling or Size of the Side	2 (D P)	2½ (D P)	3 (D P)	3½ (D P)	4 (D P)	4½ (D P)	5 (D P)	5½ (D P)	6 (D P)	6½ (S D P)	7 (S D P)	7½ (S D P)	8 (S D P)	8½ (S D P)	9 (S D P)	9½ (S D P)	10 (S D P)	10½ (S D P)	11 (S D P)	11½ (S D P)	12 (S D P)
2	0.5																				
2½	0 6	1 0																			
3	1.0	1.2	1 4																		
3½	1 1	1 3	1 6	2.0																	
4	1.2	1 0	2 0	2.2	2.5																
4½	.4	1 7	2.2	2.4	3 0	3 3															
5	1.5	2 0	2.4	2.7	3 2	3 6	4.1														
5½	1.7	2.[illegible]	[illegible] 6	3 2	3 5	4.1	4.4	5 0													
6	2.0	2 4	3.0	3 4	4 0	4 4	5.0	5.4	6 0												
6½	2.[illegible]	2 [illegible]	3 2	3 6	4 [illegible]	4.7	5.3	5 7	6 4	0 7 0											
7	2 2	2 6	3.4	4 0	4 5	5.2	5.6	6.2	7 1	0 7 4	0 8 1										
7½	2 4	3.1	3 6	4 [illegible]	5 0	5.5	6.2	6.7	7 4	0 8 0	0 8 6	0 9 3									
8	2.5	3 2	4.0	4 5	5.2	6.0	6 5	7 2	8 0	0 8 5	0 9 2	0 10 0	0 10.5								
8½	2.6	3 4	4 2	4.7	5.5	6.3	7.0	7.6	8.4	0 9.1	0.9 7	0 10 4	0.11 2	1.0 0							
9	3.0	3 6	4 4	5 2	6 0	6 6	7 4	8 2	9 0	0 9 6	0 10.4	0 11 2	0.11.7	1 0 6	1 1 4						
9½	3 1	3 7	4.6	5 4	6.2	7.1	7 7	8 5	9 4	0 10 2	0.11 0	0.11.7	1 0 4	1 1 3	1.2 2	1 3 0					
10	3 2	4.1	5.0	5 6	6 5	7 4	8 2	9 1	10 0	0 10 6	0 11 5	1 0 4	1.1.8	1 2 1	1.3 0	1.3 [illegible]	1 4 5				
10½	3.4	4.3	5.2	6.0	7 0	7.7	8 6	9 5	10 4	0.11 3	1.0.2	1 1.1	1.2.0	1 2 7	1 3 6	1 4 4	1.5 4	1.6.3			
11	3.5	4.4	5 4	6.3	7.2	8 2	9 1	10 0	11 0	0 11 7	1.0.6	1 1 6	1.2 5	1 3 4	1 4 4	1 5 3	1 6 2	1 7 2	1 8 0		
11½	3.6	4.6	5.6	6 6	7.5	8.5	9.4	10.4	11 4	1 0 3	1.1.3	1.2.3	1.3 2	1.4.2	1.5 2	1 6 2	1 7 1	1.8.1	1 9 0	1.10.0	
12	4 0	5 0	6 0	7.0	8 0	9 0	10 0	11 0	12 0	1 1 0	1 2 0	1 3 0	1.4.0	1 5 0	1 6 0	1 7.0	1 8 0	1.9.0	1 10.0	1.11.0	2 0.0



An INSPECTIONAL Table Shewing the exact Module for the [illegible]ing the Columns or Pilasters in to Proportion to any of the Five Orders in Architecture [illegible] ght required in all the Variety of [illegible] that can possibly happen in Practice

Height of the Columns and Pilasters F. I.	Tuscan: Columns I.P.	Tuscan: Column and Entablature I.P.	Tuscan: Col. Entab. & Base I.P.	Tuscan: Column and Pedestal I.P.	Doric: Columns I.P.	Doric: Column and Entablature I.P.	Doric: Col. Entab. & Pedestal I.P.	Doric: Column and Pedestal I.P.	Ionic: Columns I.P.	Ionic: Column and Entablature I.P.	Ionic: Col. Entab. & Pedestal I.P.	Ionic: Column and Pedestal I.P.	Composite: Columns I.P.	Composite: Column and Entablature I.P.	Composite: Col. Entab. & Pedestal I.P.	Composite: Column & Pedestal I.P.	Corinthian: Columns I.P.	Corinthian: Column & Entablature I.P.	Corinthian: Col. Entab. & Pedestal I.P.	Corinthian: Column & Pedestal I.P.
5 0	8.4	[illegible]	5.9	6.[illegible]	8	6.0	4.4	5.[illegible]	[illegible]	5.9	4.[illegible]	5.[illegible]	0.5	5.3	[illegible]	4.14	6.0	5.0	4.0	4.10
3	9.0	7.3	5.2	7.[illegible]	7.14	6.4	[illegible]	[illegible]	[illegible]	5.13	4.10	5.6	6.10	6.7	[illegible].10	5.2	6.4	5.4	4.5	4.13
6	9.[illegible]	7.9	6.2	7.5	8.4	[illegible]	[illegible].5	[illegible]	[illegible]	[illegible].0	4.14	5.10	7.1	6.11	[illegible].4	5.[illegible]	6.4	5.8	4.6	5.1
9	9.12	7.14	[illegible].6	7.10	8.10	6.14	5.[illegible]	6.[illegible]	[illegible].10	[illegible].6	5.[illegible]	5.4	7.[illegible]	[illegible]	5.[illegible]	[illegible].10	6.14	5.12	4.9	5.5
6 0	10.4	8.4	[illegible].11	[illegible]	9.0	[illegible]	5.13	[illegible].1	8.7	6.1	5.5	6.3	7.9	6.4	[illegible].5	[illegible]	7.3	6.0	4.13	5.9
3	10.[illegible]	8.9	6.[illegible]	[illegible].5	[illegible].6	[illegible].4	6.1	7.4	8.5	[illegible].15	5.8	6.7	[illegible].14	[illegible].9	5.8	[illegible]	7.8	6.4	5.0	5.12
6	[illegible].7	8.15	[illegible].4	[illegible].10	[illegible]	[illegible].6	5.7	[illegible]	8.[illegible]	[illegible].7	[illegible].12	6.11	8.3	6.13	5.12	6.[illegible]	7.11	6.8	5.3	6.0
9	[illegible].9	9.[illegible]	[illegible].9	9.0	[illegible]	[illegible].1	[illegible].9	7.13	9.0	[illegible].9	6.0	6.15	8.8	7.1	6.0	6.10	8.1	6.12	5.6	6.3
7 0	12.3	9.[illegible]	[illegible]	9.5	[illegible].8	8.[illegible]	6.13	8.2	9.5	[illegible].13	[illegible].3	7.5	8.13	7.5	6.3	6.[illegible]	8.6	7.0	5.9	6.7
3	12.6	9.15	8.0	9.0	[illegible].4	8.1	7.0	8.7	9.10	8.9	6.7	7.7	9.2	7.10	6.7	7.1	8.11	7.4	5.5	6.11
6	12.13	[illegible]	8.[illegible]	[illegible]	[illegible].4	[illegible].0	7.3	8.[illegible]	10.0	8.[illegible]	6.10	7.11	9.7	7.14	6.10	7.[illegible]	9.0	7.8	6.0	6.14
9	13.[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible].4	7.8	9.0	10.4	8.1	6.14	7.15	9.[illegible]	8.2	6.14	7.[illegible]	9.4	7.12	6.3	7.2
8 0	13.11	10.5	8.[illegible]	[illegible]	[illegible].0	[illegible].9	7.12	9.4	11.10	8.15	7.1	8.3	10.1	8.6	7.1	7.13	9.9	8.0	6.6	7.0
3	14.2	[illegible].1	9.[illegible]	[illegible]	[illegible].6	[illegible].4	8.0	9.9	11.0	9.3	7.5	8.[illegible]	10.6	8.[illegible]	7.5	8.1	9.14	8.4	6.9	7.10
6	[illegible].9	11.[illegible]	9.8	[illegible]	[illegible]	10.3	8.4	9.13	11.5	9.8	7.8	8.11	10.11	8.15	7.8	8.5	10.5	8.8	6.13	7.13
9	[illegible].0	12.0	[illegible]	[illegible]	[illegible]	[illegible].8	8.8	10.2	[illegible].10	9.12	[illegible].2	8.15	11.0	9.3	[illegible].12	8.9	10.8	8.12	7.0	8.1
9 0	15.0	[illegible]	10.[illegible]	[illegible]	[illegible]	[illegible]	8.[illegible]	[illegible].7	12.0	[illegible].0	8.0	9.4	11.5	9.7	8.0	8.13	10.12	9.0	7.3	8.5
3	[illegible].8	[illegible].10	10.4	[illegible]	[illegible]	[illegible].1	9.0	[illegible].1	12.5	10.4	8.3	9.8	[illegible].10	9.11	8.3	[illegible].1	11.3	9.4	7.6	8.9
6	[illegible].4	13.0	10.9	[illegible].10	4.[illegible]	[illegible].6	9.[illegible]	11.0	12.10	10.0	8.7	9.12	12.0	9.15	8.7	9.[illegible]	11.6	9.8	7.9	8.12
9	[illegible].13	[illegible]	15.[illegible]	[illegible]	[illegible]	[illegible].1	9.8	11.4	13.0	10.13	8.10	9.[illegible]	12.5	10.3	8.10	9.9	11.12	9.12	7.15	9.0
10 0	7.[illegible]	[illegible].1	11.2	[illegible].4	15.[illegible]	[illegible]	6.7	11.10	13.5	[illegible].9	8.14	10.4	12.10	10.8	8.14	9.13	12.0	10.0	8.0	9.3
3	[illegible].9	14.1	11.6	[illegible].10	[illegible].6	9.1	5.[illegible]	[illegible]	13.0	11.6	9.1	10.8	12.15	[illegible].12	9.1	10.0	12.4	10.4	8.3	9.7
6	18.0	14.7	11.[illegible]	[illegible].0	5.[illegible]	[illegible].9	10.[illegible]	12.3	[illegible].0	11.1	9.5	10.12	13.1	11.0	9.6	10.4	12.8	10.8	8.6	9.11
9	18.6	14.[illegible]	12.[illegible]	[illegible].5	[illegible].2	[illegible].14	[illegible]	12.7	[illegible]	[illegible].12	9.8	11.0	13.9	11.4	9.8	11.8	12.14	10.12	8.9	9.14
11 0	18.13	15.[illegible]	12.4	[illegible].10	[illegible].8	[illegible]	[illegible]	12.[illegible]	14.[illegible]	12.4	9.12	11.5	13.14	11.9	9.13	10.12	13.3	11.0	8.13	10.2
3	19.4	[illegible].7	[illegible].15	[illegible].0	[illegible].4	13.8	10.[illegible]	[illegible]	14.0	12.9	10.0	11.4	14.3	11.13	10.0	11.0	13.8	11.4	9.0	10.6
6	19.1	15.3	12.[illegible]	15.[illegible]	[illegible].4	[illegible].12	[illegible].9	[illegible]	14.5	12.13	10.3	11.13	14.8	12.1	10.3	11.4	13.12	11.8	9.3	10.10
9	20.9	16.[illegible]	[illegible]	15.10	17.0	[illegible]	[illegible].7	[illegible]	15.10	13.9	10.7	12.1	14.12	12.5	10.7	11.8	14.1	11.12	9.6	10.13
12 0	20.0	10.[illegible]	13.[illegible]	[illegible]	18.[illegible]	[illegible].6	[illegible]	[illegible].4	16.0	13.6	10.10	12.6	15.2	12.10	10.11	11.12	14.6	12.0	9.9	11.[illegible]
3	[illegible]	[illegible].12	13.[illegible]	16.4	[illegible].9	6.[illegible]	[illegible]	[illegible].3	16.4	13.1	10.14	12.10	15.7	12.14	10.14	12.0	14.11	12.4	9.13	11.5
6	[illegible].5	[illegible].13	[illegible].6	[illegible]	[illegible]	[illegible].6	[illegible]	[illegible]	16.10	[illegible].15	11.1	12.14	15.12	13.2	11.1	12.4	15.0	12.8	10.0	[illegible].9
9	[illegible].3	[illegible].8	[illegible].1	7.[illegible]	17.2	15.[illegible]	[illegible].6	[illegible].12	[illegible].0	14.3	11.5	13.2	16.1	13.0	11.3	12.8	15.4	13.1	10.3	[illegible].12



A
GENERAL TREATISE
OF
ARCHITECTURE.
BOOK III.

A PARALLEL of ARCHITECTURE,

In a Collection of Ten principal AUTHORS who have Written upon the Five ORDERS, *viz.*

PALLADIO and SCAMMOZZI,

SERLIO, and VIGNOLA,	ALBERTI and VIOLA,
D.BARBARO, and CATANEO,	PERRAULT, and L'CLERC.

PALLADIO and SCAMMOZZI, on the *Tuſcan Order.*

ANDREW PALLADIO, of all the Architects of his Time, the moſt Judicious, and to whom, in this Collection, we aſſign the moſt eminent Place, who, finding this Compoſition too meanly handled by *Vitruvius* and others, to merit the Honour of an *Order*; this induſtrious Architect went and ſearched among the Reliques of Amphitheatres, which are thoſe enormous Maſſes of Architecture, where the Solidity of the Building was more requiſite than the ſpruceneſs and delicacy of the *Orders*; 'till, in fine, he diſcovered in the Arena's of *Verona*, *Pola*, and other Places, a certain *Order*, which he conceived one might call the *Tuſcan*; in Imitation whereof, he compoſed this: For he did not tie himſelf preciſely to follow one rather than the other, but from many he formed and ordained this. That of his Companion *Scammozzi*, might paſs tollerably well, had he not aſſigned it too great a Conformity with the *Doric*, and not ſo much as once mentioned where he had ſeen any like it; ſo as being altogether Modern, and near as rich in Mouldings as the *Doric* itſelf; it were much better to make uſe of the Antique; this being nothing conſiderable for a Building, but for its Cheapneſs and the ſaving of Timber.

The Height of the Column with its Baſe and Capital is of ſeven Diameters only, according to *Palladio*, *Scammozzi* allows his ſeven and a half, the Entablature contains ¼ of the Column.

PALLADIO and SCAMMOZZI, upon the *Doric Order.*

Palladio allows but fifteen Modules to the Column without the Baſe, and with its Baſe he makes it of ſixteen, and ſometimes proceeds even to ſeventeen and a third. The reſt of the Meaſures are ſo diſtinctly marked, upon the Profile, that it were ſuperfluous to explain them.

Scammozzi gives ever preciſely ſeventeen Modules to his Column, accommodating it with the ſame Baſe that *Palladio* does; but to a great deal leſs Purpoſe, in as much as he thinks fit to deck the

Tore's with I know not what delicate Foilages, which does not at all become the *Order*, no more than does the *Ionic* Fluting, which is abusively employed in this Place, instead of the natural *Doric*. This Entablature as well as that of *Palladio*, sufficiently resembles our second Model to which he has only added a small Cavity, betwixt the Corona, and the Quarter-Round, a thing not at all considerable.

In the Composition of this Profile taken in the Gross, and altogether simple, appears a very great Idea; but the Ornaments are to be rejected.

PALLADIO and SCAMMOZZI, upon the *Ionic Order*.

There is so great a Resemblance betwixt the Mouldings, and the Measures of these two Profiles, that the Difference is hardly considerable, unless it be in the Figures of the Capitals; which in truth is very different in Shape, tho' sufficiently resembling in Proportion.

The Voluta of *Scammozzi* in particular, and by consequence hath less of the Antique, than that of *Palladio*. But *Scammozzi* has excogitated this Expedient, that his Capital might front on all Sides, not liking, it may be, this variety of Aspect, which we find in the ordinary Volutas.

The Altitude of the Column, according to *Palladio*, contains nine Diameters, which make after our Measure eighteen Modules; of which, he gives to the Entablature but one fifth Part, being the same Proportion which he hereafter assigns to his *Corinthian*. He had yet, peradventure, done better to have contriv'd for this here, a more proportionable Medium betwixt the *Doric* and the *Corinthian*, proceeding by a certain Gradation, from the solid Kind, to the delicate. Moreover, I cou'd have wish'd, that the Cornice had rather been toothed, than modillioned.

As for *Scammozzi*, besides that the same Observation which I made on the Profile of *Palladio* is repugnant to him, there is this yet worse, that the Capital being a great deal more Massy, instead of giving a greater Height to his Cornice, and composing it of more ample Members, he has contrarily made it less, and cut off three or four Reglets, which renders it very dry and trifling.

PALLADIO and SCAMMOZZI, upon the *Corinthian Order*.

Amongst all the excellent Pieces and Examples delivered by the Ancients, for the *Corinthian Order*, there is not one of the Proportions which these two Masters here observe, who make their Entablature, but $\frac{1}{5}$ of the Column; however, when I consider their great Reputation, whose Works even Emulate the best of their Predecessors; and the Reason which they alledge for discharging the Columns proportionably as they are weakened by the Altitude and Diminution of their Shaft, according to the Delicateness of the *Orders*, I can neither contradict their Judgment, nor blame those who wou'd imitate them.

Palladio makes his Column but of $9\frac{1}{2}$ Diameters, *viz.* 19 Modules, so as the Difference of the Height observed betwixt his Entablature, and that of *Scammozzi*'s proceeds from *Scammozzi*'s Columns being of 10 Diameters, which likewise is an excellent Proportion; and indeed more usual than the other amongst the Antients.

PALLADIO and SCAMMOZZI, upon the *Composite*.

Palladio proposing this Profile of the *Composite*, which he also Names the *Latin Order*, (to make it specifically differ from some others which bears the same Appellation) gives a general Maxim for its Proportion, which is to make it resemble the *Corinthian*, the Form only of the Capital excepted. And though he adds, that this *Order* ought to be somewhat more decked and gay than the *Corinthian*; it is to be understood in reference only to those who allow the *Corinthian* Column but 9 Diameters; whereas this should ever have 10.

Scammozzi's Profile has not so good a Grace, as that of *Palladio*, nor is it indeed so exact in the Regularity of its Entablature with the Column, where it wants but 3 Minutes upon the Total to make it precisely $\frac{1}{5}$; for, tho' this be but a very small Matter, yet since it had been better to have a little exceeded, than to come short (the Antients commonly allowing $\frac{1}{4}$, or at least $\frac{1}{5}$) the Defect is the more easily perceived. But what is yet worse is, that in the Composition of the *Cornice* he has accumulated so many small Members, one upon the other, as renders it trifling, and a little confus'd.

SERLIO and VIGNOLA, upon the *Tuscan Order*.

We may see in Plate I. the *Tuscan Order* of *Palladio*, and *Scammozzi*, in its most advantageous Lustre; but methinks here it is extremely decayed, especially in the Profile of *Serlio*, where the whole is too plain and particular, being the only Person who has allowed to every Member of the *Order* in general, Base, Capital, Architrave, Frize, and Cornice; a like Altitude, this equality being here but a false Kind of Proportion, and wholly Repugnant to what Architecture has borrowed from the Opticks.

Vignola has in this respect proceeded more Rationally, adding to each Member what it might diminish of its Magnitude, by the Distance from the Eye; and therefore he has made the Cornice somewhat higher than the Frize or Architrave.

Serlio

Serlio allows this Column but 6 Diameters, tho' *Vitruvius*, (whom he always ſtrives to follow) gives it 7, in the 7th. Chapter, of his 4th. Book, where he Treats of building Temples after the *Tuſcan* Manner.

Vignola, as to what imports the Column, conforms himſelf to *Vitruvius*; but for the Mouldings of the Capital, and Cornice, is governed wholly by his particular Fancy.

The Entablature both in the one and the other of thoſe two Profiles, conſiſts of a quarter of the Column.

To the READER.

It were altogether a fruitleſs Study, and but Labour loſt, to continue any longer in queſt of this *Order*, after other Architects, beſides thoſe four, whoſe Deſigns I have produced; I am therefore reſolved to proceed no farther, conſidering withall that thoſe who remain, are (for the moſt part) of *Vitruvius*'s School (except *L'Clerc*, and *Perrault*, whoſe *Tuſcan* I ſhall treat of in its proper Place) from whence it is exceedingly difficult to collect any thing more eſſential to the *Tuſcan Order*, than the meer ſimple Form of the Baſe and Capital, which are already deſcribed in the Profile of *Serlio*, whereof the Repetition wou'd be but ſuperfluous; as to what concerns the Entablature, ſince there remains extant no antient, well confirmed and poſitive Example; nor indeed ſo much as any intelligible Deſcription of it in the Writings of *Vitruvius*; I ſhall make no great reckoning of their Inventions. I have likewiſe obſerved that *Leon Baptiſta Alberti* (the very beſt of thoſe which remain after *D. Barbaro*) has ſpoken of it, but only curſorily, as in truth making no account of it, and without giving ſo much as a Profile. As little does he eſteem the Compoſition, of which *Vitruvious* too has been altogether ſilent.

SERLIO and VIGNOLA, upon the *Doric Order*.

Theſe two Maſters are infinitely obliged to their Interpreters, who produced them firſt amongſt the Tramontani and Strangers, and particularly to our Workmen in *France*, who hold them in very great Eſteem; and though they are in truth, highly worthy of it, nevertheleſs being compared to the Preceding two, they loſe much of their Luſtre, and come exceeding ſhort of them.

But it were not juſt we ſhould treat *Serlio* in this Examination with the ſame Rigour we have done his Companion; for that intending to follow *Vitruvius*, who is the moſt renowned and venerable Author of the Antients, he has worthily acquitted himſelf: Whereas *Vignola*, who has purſued another Courſe, really a more noble, and the very ſame which I alſo obſerve here, knew not how to proceed without Deviation. The *Doric* Profile which he here preſents us, is taken out of the firſt *Order* of the Theatre of *Marcellus*, and the moſt worthy of this Kind that is to be met with amongſt all the Roman Antiquities.

Serlio gives here only 7 Diameters to his Column, comprehending the Baſe and Capital, and the Height of the Entablature amounts to 3 Modules, and a little more than $\frac{1}{2}$, in ſo much as, contrary to his ordinary Cuſtom, he extremely exceeds the Quarter of this Column, which is the largeſt Proportion the Antients did ever practiſe; ſo as this great Exceſs puts me in doubt whether the Text of *Vitruvius*, upon which he relies, be not corrupted in that Place, or elſe when he ſpeaks of the Column, he did not mean the Shaft without its Capital, for ſo by adding one Module more, which is the preciſe Height of the Capital, the entire Height of the Column wou'd be 15 Modules, and conſequently the Entablature hold Proportion conformable to the Antients.

Vignola forms his Column of 16 Modules, and the Entablature of 4, which is exactly $\frac{1}{4}$ of the Column, and which makes it appear very regular.

SERLIO and VIGNOLA, upon the *Ionic Order*.

The Inequality of theſe two Profiles, is ſo wide, that it is almoſt impoſſible to approve of them both, and yet there is in a manner as little Reaſon to condemn the one as the other, each of them having its Principles ſufficiently regular.

The firſt, which is *Serlio*, having had an Opportunity of making a collection of ſeveral of the moſt conſiderable Antiquities in *Italy*, from whence he might have taken a noble Idea of the *Orders*, is returned back to the School of *Vitruvius*, whither the Slenderneſs of his Genius has recalled him.

On the contrary, *Vignola* is fallen with exceſs into the other Manner, that we may name the Grand; which though indeed more Noble, and Advantageous, has yet for all its Limits, which being once exceeded, becomes vicious and extravagant.

Now the great Difference of theſe two Maſters proceeds from *Serlio*'s making his Column but of 7 Diameters and a half, allowing only $\frac{1}{5}$ to the Entablature; and *Vignola*'s compoſing his of 9 Diameters, and his Entablature a full quarter of a Column.

That which I chiefly approve in this laſt is, that he makes uſe of the Baſe which *Vitruvius* compoſed for his *Ionic*; a thing not to be excuſed, but in thoſe who follow him, likewiſe in all the reſt: For others who have endeavoured to follow the Antique, have no Reaſon to employ it, there being

no

no Precedent for it: And in truth also, it never has had the Approbation of the ablest Modern Masters, who upon Examination, have greatly wonder'd that *Vitruvius* shou'd impose so vast a Torus, upon so small Cinctures, charging the strong upon the weaker, which being totally repugnant to the Order of Nature, is very offensive to the Eyes of the Curious.

SERLIO and VIGNOLA, upon the *Corinthian Order.*

Methinks I see here a Giant next a Pigmy; so monstrous is the Disproportion, betwixt these two Masters, and the Reason of so extraordinary Inequality proceeds from two Causes; whereof the first is, that *Serlio* allows to the Entablature of his Profile but ⅕ of his Column, whereas *Vignola* makes his ¼; and exceeds that even by some Minutes. The second is, that *Serlio* following *Vitruvius*, makes the Height of this Column but 9 Diameters, and *Vignola* gives his Ten; the same which I formerly observed in the *Ionic Order*, where we meet the very same Inconvenience. But though the Difference of these two Profiles, be in general very considerable, yet coming to the Particulars, what we find in their Capitals is of greater Consequence; since we must of necessity condemn that of *Vitruvius*, prescribed in his IV. Book, towards the End of the first Chapter; there being no Reason to prefer it alone to an almost innumerable Number of most excellent Models which remain of Antiquity; among which we meet with none in the same Terms with which he has reduced the Height of his own; unless it be that out of Respect to this grave Author, who is indeed worthy the Reverence of all those of the Profession; and to avoid the invidious Name of Critic, we ought to chuse a gentler Way; which is to elude Question after their Examples, who have already observed the same Mistake before us, either in Effect, or out of Modesty, believed the Text to have been corrupted in this Place, as well as in divers others, where the Alteration is manifest; so as assisting the Sense a little, one may suppose that *Vitruvius* designing the Height of the *Corinthian* Chapter, by the Largeness of the Diameter of its Column, he shou'd not have comprehended the Abacus, which is the sole Ambiguity of this Passage, and which indeed deserves Correction; or to be otherwise understood than *Serlio* comprehends it.

SERLIO and VIGNOLA upon the *Composite Order.*

I am astonished at this last Production of poor *Serlio*, who having till now, reasonably well conducted the first *Orders* of Architecture under the Direction and Government of *Vitruvius*, fails miserably at the very Port, just as his Pilot has deserted him: And what does most of all surprize me, is, that the Man's Genius (which was to intimate a mean and trifling Manner) shou'd revolt in such an Instant; and change into so strange an Excess. I was at first resolved to have suppressed this Profile (for the Credit of the Person) had it not been to wrong his Competitor *Vignola*, and to frustrate him of the great Advantage, which, upon this Occasion, he has over him; since in the precedent *Orders*, I have sometimes conceived him his Inferior. I shall not dwell long upon the Particulars, which in this Composition seems to me defective, because I shall sooner have finished in saying once for all, that there is nothing as it shou'd be, tho' the Cornice be taken from, and (as the Author pretends) follow'd Stroak for Stroak after that of the 4th Order of the *Collosseum*, which is indeed one of the most renowned Vestigia's of Antiquity, and an admirable Piece of Architecture. But one had need of a very steady Head to climb such an Height without shaking ones Judgment. He shou'd have consider'd that this *Collossean* Structure, being a Mass of a prodigious Altitude, had need of some Sophistications from the Opticks, to make it appear regular to the Eye, and that therefore there would be an Error and Mistake in summing up the Dimensions and Æquipondium of its Members at a more moderate Distance with the same Measures and Proportions. This Inadvertency has made him slip into another Fault much more gross and unpardonable; for he places upon a small and pitiful Capital (after his own Mode) the whole Weight of the Colosseum, that is to say, a gigantick Entablature, which composes the Corona of this prodigious Edifice. This so monstrous a Medley appears more in the Author; because he has designed it very slightly, and in so small a Volume (in his 4th Book, and 9th Chapter, where he explains this last *Order*) that one can hardly discern the Form of the principal Members.

Vignola has proceeded with a great deal more Exactness and Judgment in his Designs, which he has also profiled very neatly, and in a large Volume, that renders it commendable, and of Use to Workmen. He allows in this Composition the same Measures and Proportions, that he does to the *Corinthian.*

DANIEL BARBARO and PETER CATANEO upon the *Doric Order.*

This is here a perfect School of Father *Vitruvius*, whose very Name and Authority, does extremely recommend it to us, not that we are obliged indifferently, and without Choice, to follow al' those who pretend to have understood this grave and abstruse Author, seeing every Man strives to make him of his own Party, and to accommodate him to his particular Genius.

The

The very best of them all was without Exception, *Daniel Barbaro*, as well for his excellent Commentaries, as for the Exactitude and Clearneſs of his Deſigns. A Man may perceive by the Parallel of his Profile, with that of *Cataneo*, that his Adjunct of *Serlio* above, and ſome following his Claſs, that he preſides a Maſter among his Diſciples.

It were an Amuſement to no Purpoſe, and very impertinent, ſhould I quote every minute and ſmall Difference of one Deſign from the other; ſince the Reader may better ſee it by one Caſt of his Eye, than I deſcribe it to him here.

I will add only this general Advertiſement, that the Proportion of the Column, with its Entablature, is the ſame here, which *Serlio* gave us before, without being neceſſitated to repeat my own Opinion thereof, ſince my Obſervation is upon *Vitruvius*, and againſt thoſe who have explained him.

Daniel Barbaro, has judiciouſly introduced a Buckler in the angular Metope of the Frize, thereby ſignifying, that all Ornaments ſhould be accommodated to the *Orders* which they are applied to; and that this being of a robuſt and martial Kind, one may, as Occaſion requires, enrich it with Trophies of Arms, Clumbs, Quivers of Arrows, and ſuch like Inſtruments of War.

To the Prejudice of *Cataneo*'s Deſign, I find that the Gula of the ſuperior Part of the Entablature is ſomewhat too great; that the Projection of the Plinth of the Capital is ſomewhat too ſmall, and renders the whole Capital mean and ſhort, which extremely disfigures his Profile; beſides that, the Baſe below has the Exceſs which is defective in the Chapter above.

BARBARO and CATANEO upon the *Ionic Order*.

You have here the very ſame Style that *Serlio* obſerves in his, and tho' there be much Reſemblance in the Profiles of all the three Maſters, nevertheleſs, we muſt reckon that as to the Meaning of *Vitruvius* (to whoſe Doctrine they have univerſally endeavoured to conform themſelves) *Daniel Barbaro* is the Captain and chief Conductor, as may be eaſily diſcerned from the Pattern of the Contours only, belonging to the Voluta of the Capital, which is a moſt eſſential Piece in this *Order*, and whoſe Draught was never ſo much as known to the ancient Architects before, to whom we are obliged for the Recovery of this excellent Maſter-piece of antient Architecture, tho' he has had the Goodneſs to divide the Glory of it with his contemporary and intimate Friend *Palladio*, by whoſe Conference and Help, he acknowledges to have been aſſiſted in the Delineation of all his Deſigns.

I find nothing obſervable in theſe two Profiles, beſides a certain Simplicity and Plainneſs; for the Reſt, the Difference of the Entablature, as well in Relation to the Height as Shape, is ſo ſmall, that it is nothing at all conſiderable; what is more worthy of Remark in the Deſign of *Daniel Barbaro*, is this, that he gives to every Face of the Architrave, a certain Slope or kind of downward, or inclining Stroak, as it is expreſſly ordained in *Vitruvius*'s third Book toward the Period of the laſt Chapter. But I find that the Rule of Perſpective, upon which he grounds it, is more refined and ſubtile for its Diſcourſe, than any way ſolid in the Execution, and beſides, I never ſaw any Example of it in any Work whatſoever.

BARBARO and CATANEO upon the *Corinthian Order*.

Of all the four *Orders* of Architecture deſcribed by *Vetruvius* (for he ſpeaks not a Word of the *Compoſita*, which is the fifth) this of the *Corinthian* appears to me to be the moſt ſlightly handled, conſidering the nobleneſs and magnificence of its Inventors, who having ſpared no Coſt to render it rich and excellent beyond all the reſt, were not likely to borrow any thing from thoſe among whom they were ranked. I conceive that *Vitruvius* therefore at the beginning of his fourth Book, had no Reaſon to affirm that they uſed to employ the Entablature, of the *Ionic*, and ſometimes even the *Doric* Column alſo, without any other Addition ſave the Capital of their own Invention; ſince by the antient Examples of this *Order*, we find the contrary: But *Barbaro*, his Commentator, whoſe Deſign is before us, is by no means to be blamed for it, whoſe Province was only to expreſs the Meaning of the Author whom he explained, and of which he has very worthily acquitted himſelf.

He has therefore fitted an *Ionic* Entablature to this *Corinthian* Profile, forming the Capital of *Acanthus' Leaves*, conformable to the Deſcription, and Hiſtory of its Original, mentioned by *Vitruvius*. I wou'd not for all this, adviſe any Workman to make uſe of this Compoſition, without firſt conſidering the relative Proportion, which the Entablature ought to have, with the whole of the *Order*, a thing that I find is here extremely changed; and a great deal leſs than it ſhou'd be, by Reaſon of the conſiderable Height which the Column has received by that of the *Corinthian* Chapter, which is $\frac{1}{3}$ higher than the *Ionic*: But this is remedied by enlarging the Frize, and by adding ſome new Mouldings to the Cornice, betwixt the Corona, and the Denticles, as a quarter Round or ſo, for to carve the Eggs, and Anchors in.

The Design of *Cataneo* has nothing in it remarkable, unless it be the extravagant Projecture, which he allows to the Fillet of his Dentelli; as we also find in the Design of *Barbaro*. They have both in this followed the Maxim which regulates the Projecture of every Member to its Height, which Rule is not always to be receiv'd.

What I have said in *Serlio* and *Vignola* before, touching the Height of the Capital according to *Vitruvius*, wou'd here be superfluous to repeat: It may therefore serve both for this and *L. Baptista*, and *Viola*, being of the same Spirit.

LEON BAPTISTA ALBERTI, and JOSEPH VIOLA, upon the *Doric Order*.

At Sight of this first Design *L. B. Alberti*, whose Capital is intirely *Gothic*, one might, with Reason, wonder why I shou'd speak so advantageously of him in the general Examination which I have made of the Modern Architects, amongst whom he has assigned one of the principal Places; and in earnest I cannot excuse him here of the ill Relish, and of this so ill favoured a Composition; however he pretends to have seen it, and to have taken it from some antient Fragments: But suppose it true (for one may meet with bad ones enough) he might also have found others more tolerable: That which falls out the most unluckily in this first Production of his Skill is, that it is of very great Importance for a Man to begin well, since the first Impression continues long, and introduces a consequence for those who follow after. Nevertheless, be it what it will, every Man is obliged to accord with the Truth, and to judge of things honestly and without Prejudice. And therefore to do him Justice, having first condemned his defective Point in his Profile, we are not to reject all the rest for that Reason, seeing it is in Truth of a great and noble Manner. It has also much conformity with the Antique in the Modillions, whose Projecture put into Work, wou'd produce a noble Effect, as may be judged by the Profile. His Architrave, and Frize, are both regular, and the Entablature entire to its exact Proportion with the Column; for it consists of 4 Modules in Height, and the Column of 6. The Proportions of the Base are likewise very handsome; so as in the whole Design there is nothing Scandalous besides the Capital, which may easily be supplied by borrowing from his Colleague *Viola*, whose Profile is sufficiently correct, and upon the Matter, the very same with that of *Palladio*, whom I perceive he has imitated in all the following *Orders*, as well as in this here. But since he endeavours to disguise this Theft as much as possible, in altering some of the Mouldings, or mutilating some Members, he has here made a quarter Round, instead of a direct Cymatium, or Ogee of the Cornice, which is but a thing indifferent, or tollerable at least, in the *Doric Order*.

ALBERTI and VIOLA, upon the *Ionic Order*.

The Conformity of these two Designs to these of *Palladio* and *Scammozzi* is so conspicuous, that one may easily judge of their mutual Assistance to each other; *viz.* That *Viola* made bold with that of *Palladio*, as he did before in the *Doric*: And that *Scammozzi* has imitated *Alberti*, who is his Senior above an hundred Years. For the rest, it were a difficult thing to decide which of these two Profiles is to be preferred, in regard the *Ionic Order*, has been so diversly treated by the Antients. That which I wou'd have wished for here, as conducing to a greater and more exact Regularity, shou'd have been, to have cut the Dentelli upon the flat Band of *Alberti*'s Design, since he has omitted Modillions there, which his Companion *Viola*, for observing, may be the better excused; for my Part I shou'd have rather employed Dentelli there, as an Ornament more particularly affected to the *Ionic Order*, and have reserved the Modillions for the *Order* which follows next.

The Reader may remember, or else looking back on some Pages, reflect upon what I have there observed on the Profiles of *Scammozzi*, and *Palladio*; because they so much agree with *Viola* here; to which I may yet superadd as a new Charge, that he has done ill to employ another Base different from that of the Antique, since he saw how his Master *Palladio* has preferred it before that of *Vitruvius*'s Composition: He had also done much better, to have followed precisely the Proportions of the Cornice in the same Design of *Palladio*; for in attempting to disguise his Imitation, by adding of some Members, and changing of others, he has, in fine, render'd it the more mean and trifling.

ALBERTI and VIOLA, upon the *Corinthian Order*.

I shall here need only to examine the Design of *Alberti*, that of his Competitor *Viola*, being but in Imitation, or rather a perfect Copy after the Profile of *Palladio*, which we have seen already; and to which I refer the Reader as to its Original.

As touching that of *Alberti*, I find two Particulars in his Design, which seem worthy of Reprehension; the first is, the low Proportion of the Capital, which is only pardonable in the Followers of *Vitruvius*, for we find no Example of it amongst the Antients, since even he himself imitates a Manner both greater and more noble than the *Vitruvian*. The other is observable in his Cornice, to which he has given no Corona, tho' it be a Member so essential, and one of the principal in the Entablature. But tho' this Liberty be somewhat bold, and perhaps blame-worthy, yet remains one consi-

confiderable Example at *Rome*, in the Cornice of that famous Temple of Peace, built by the Emperor *Vefpatian*, being one of the greateft and moft fuperb Reliques of Antiquity.

The Face likewife of the Modillions feem to me of the largeft, and befides, the Foilage which he puts in the Frize, (though not defcribed here) holds not fufficient Conformity with the Cornice, as too fimple and plain for fo rich an Ornament: But the Remedy is at hand, by adding a few Leaves or other Carvings on the Cymatiums of the Cornice and Architrave, with Eggs upon the Quarter-round; unlefs it be that you wou'd rather fave that Work by abating fomewhat of the Ornament of the Frize; there will yet remain this Objection ftill in the Defign; that the Author refolving rather to fix upon the Capital of *Vitruvius*, than on thofe of the Antients. He ought not to have carved them with Olive Leaves, fince *Vitruvius* does exprefsly order them of the Acanthus.

SEBASTIAN LE CLERC, and CLAUDE PERRAULT upon the *Tufcan Order*.

Having in the foregoing Pages of this Book, delivered or given a Parallel of Architecture, according to eight principal Authors, taken from a Treatife written in French firft by *Roland Freart*, Sr. of *Cambray*, and made Englifh by *John Evelyn*, Efq; Fellow of the Royal Society of *London*. I thought proper to fubjoin thereunto thefe two excellent Mafters, *viz*. *Sebaftian Le Clerc*, and *C. Perrault*; who (though they bring up the Rear in this Place, were inferior to none of thofe that went before them, efpecially the moft celebrated *Sebaftian Le Clerc*, who, in his Treatife of Architecture brought no fmall Luftre to the Art of Building; which either for Delicacy and Juftnefs of Proportion, ufeful Remarks and Obfervations, and Variety of References and ufeful Directions (worthy the Perufal of the ableft Mafters) no Treatife hitherto Publifhed can furpafs; which will be allowed by every unprejudiced and candid Judge, who fhall perufe and examine the fame, I fhall no longer trouble my Reader by expatiating on the Merit of this great Man; but fhall proceed to the Proportions of his Profiles of the five *Orders*; together with thofe of *C. Perrault*'s.

Sebaftian Le Clerc, has given us two Profiles of the *Tufcan Order*; to the firft of which he allows 22 Semidiameters, or Modules, 10 Minutes; whereof he affigns to the Pedeftal, 4 Modules, 25 Minutes; to the Column, 14 Modules, including both Bafe and Capital; and to the Entablature, 3 Modules, 15 Minutes; as may be feen in Page 47th, Book II. of his Treatife of Architecture. To his fecond Profile, he allows 23 Modules, 22 Minutes; whereof he gives the Pedeftal, 5 Modules; to the Column, including the Bafe and Capital, 15 Modules; and to the Entablature, 3 Modules, 22 Minutes. See Plate I. of this Book.

C. Perrault, allows the Profile of this *Order* 22 Modules 20 Minutes, of which he gives to the Pedeftal 4; to the Column, including Bafe and Capital, 14 Modules, 20 Minutes; and to the Entablature, 4 Modules, which is more than ¼ Part of a Column, including Bafe and Capital; and is more than any of the Antient or Modern Architects ever allowed to the Entablature of any of the five *Orders*.

I am furprized that this great Architect (who gained no fmall Reputation in the World) did not confider the many Inconveniencies that muft have refulted from giving fo heavy an Entablature to this *Order*. Firft, it is repugnant to the general Caution which all fkilful Architects give, *viz*. not to make the Cornices of the under Stories project too much; left it may hinder thofe who look out at the Windows of the upper Stories, of having a View of what paffes below; fecondly, it will very much drown the whole Edifice, and make the Cornices of the upper Stories appear mean and pitiful, notwithanding the Juftnefs of their Proportions, I fhall no longer trouble my Reader by enumerating many other Inconveniencies which muft arife from the Difpofition of this heavy Entablature, and hope he will pardon me for the Remark I juft made on this Architect, as I compiled this Treatife chiefly for the Benefit of young Beginners, and thofe who are yet Strangers to Architecture, I thought proper to Caution them againft falling into the like Miftake.

LE CLERC and PERRAULT, upon the *Doric Order*.

I fhall forbear making any more Remarks on thofe two Authors, who are very wide afunder in their Proportions, and only refer the Reader to their Profiles, which he fhall find towards the latter End of this Book.

Sebaftian Le Clerc, gives to the Profile of this *Order*, 25 Modules, 8 Minutes; whereof he gives the Column, including Bafe and Capital, 16 Modules; 5 Modules, 10 Minutes to the Pedeftal; and to the Entablature, 3 Modules, 28 Minutes.

LE CLERC and PERRAULT, upon the *Ionic Order*.

Le Clerc gives this Profile, 28 Modules, 10 Minutes; whereof he allows the Pedeftal, 6 Modules, to the Column, including Bafe and Capital, 18 Modules, 10 Modules; and to the Entablature, 4 Modules, 10 Minutes.

C. Perrault

C. Perrault gives this Profile but 26 Modules; whereof he gives the Pedeſtal, 4 Modules, 20 Minutes; to the Column, including both Baſe and Capital, 17 Modules, 10 Minutes; and to the Entablature, 4 Modules, 10 Minutes.

LE CLERC and PERRAULT, upon the *Corinthian Order*.

Sebaſtian Le Clerc allows this Profile, 31 Modules, 5 Minutes; whereof he allows the Pedeſtal, 6 Modules, 20 Minutes; to the Column, including Baſe and Capital, 20 Modules; and to the Entablature, 4 Modules, 15 Minutes; which is a very fit Proportion for this *Order*; eſpecially when it is allowed the higheſt Station, as *Le Clerc* doth with Judgment.

Perrault gives his Profile but 27 Modules, 20 Minutes; of which he gives the Pedeſtal, 5 Modules; to the Column, including both Baſe and Capital, 18 Modules, 20 Minutes; and to the Entablature, 4 Modules.

The Reaſon of the great Difference found betwixt thoſe two Profiles in their Height, is this, *viz.* that *Sebaſtian Le Clerc* aſſigns his Profile of the 5th Rank; and *Perrault* allows his the 4th Rank amongſt the *Orders*.

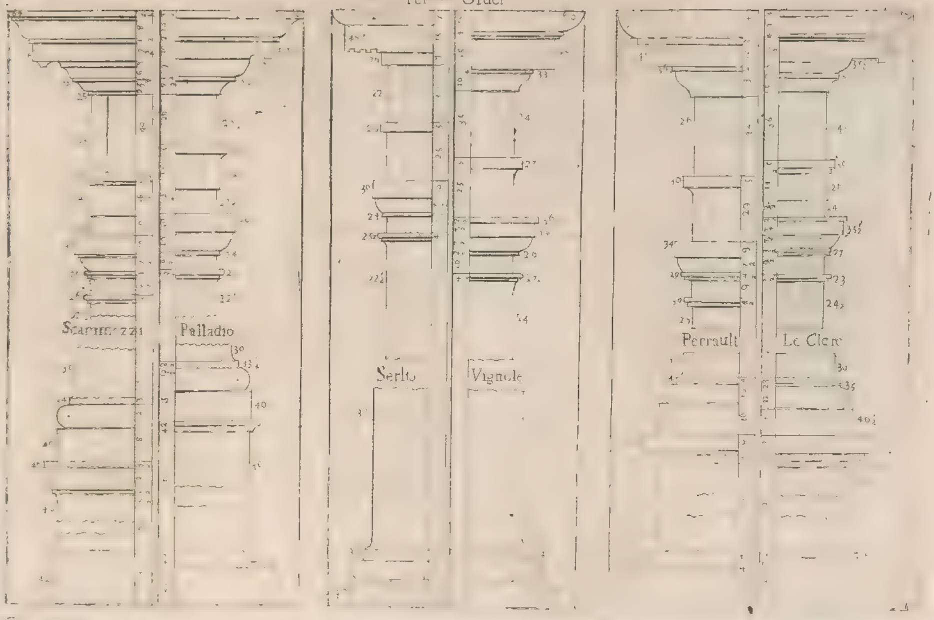
LE CLERC and PERRAULT, upon the *Compoſite Order*.

Sebaſtian Le Clerc gives the Profile of this *Order*, 30 Modules, 21 Minutes; whereof he gives the Pedeſtal, 6 Modules, 16 Minutes; to the Column, including Baſe and Capital, 19 Modules, 20 Minutes; and to the Entablature, 4 Modules, 15 Minutes.

C. Perrault gives his Profile of the Compoſite, or Roman *Order*, 29 Modules, 10 Minutes; whereof he gives the Pedeſtal, 5 Modules, 10 Minutes; to the Column, including both Baſe and Capital, 20 Modules; and to the Entablature, 4 Modules.

P.1

Tuscan Order



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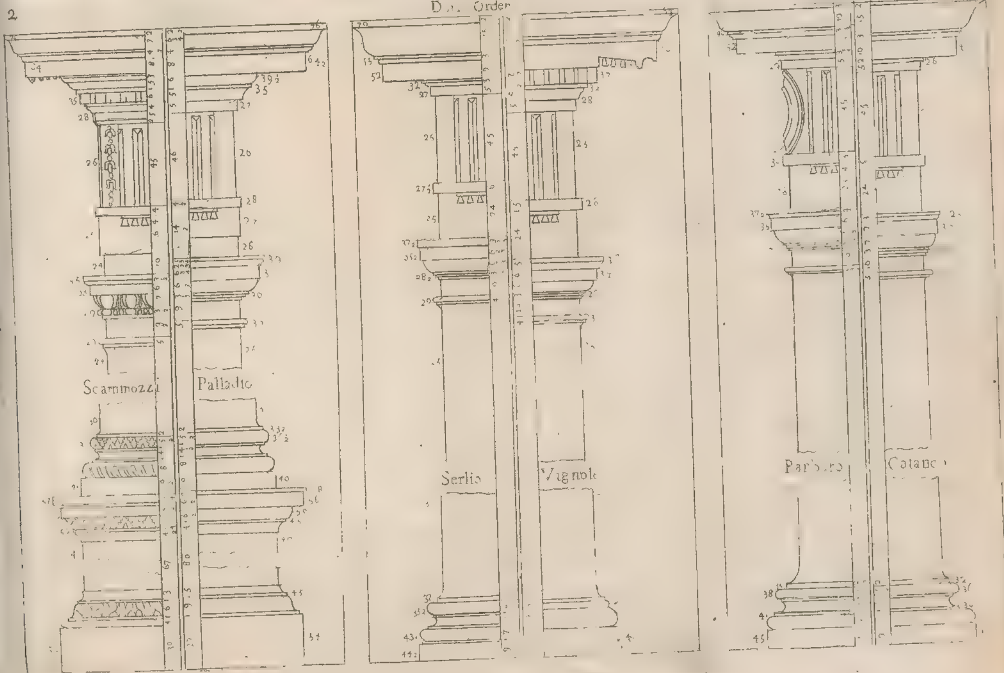

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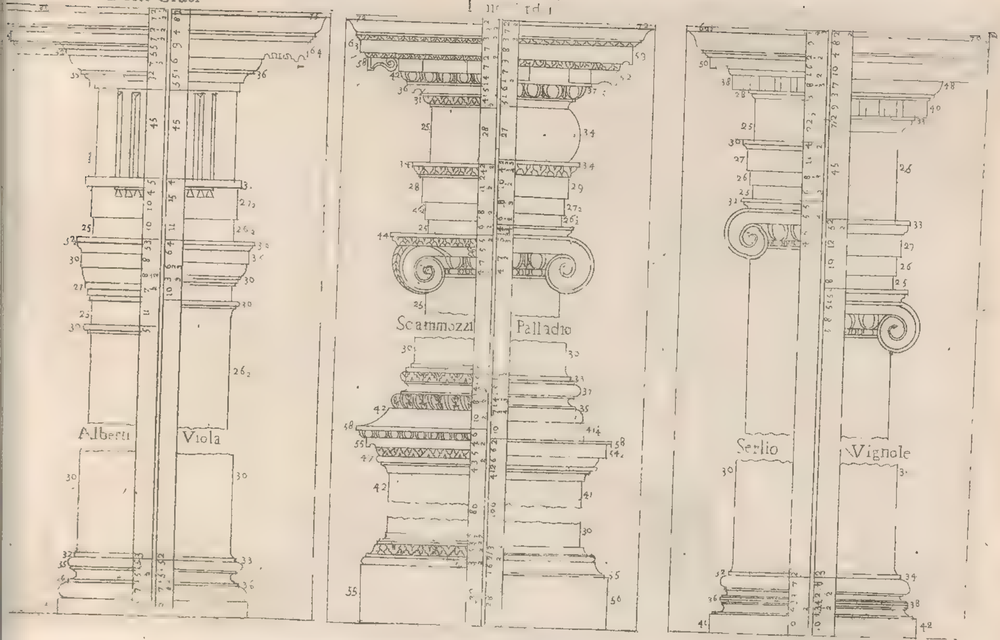

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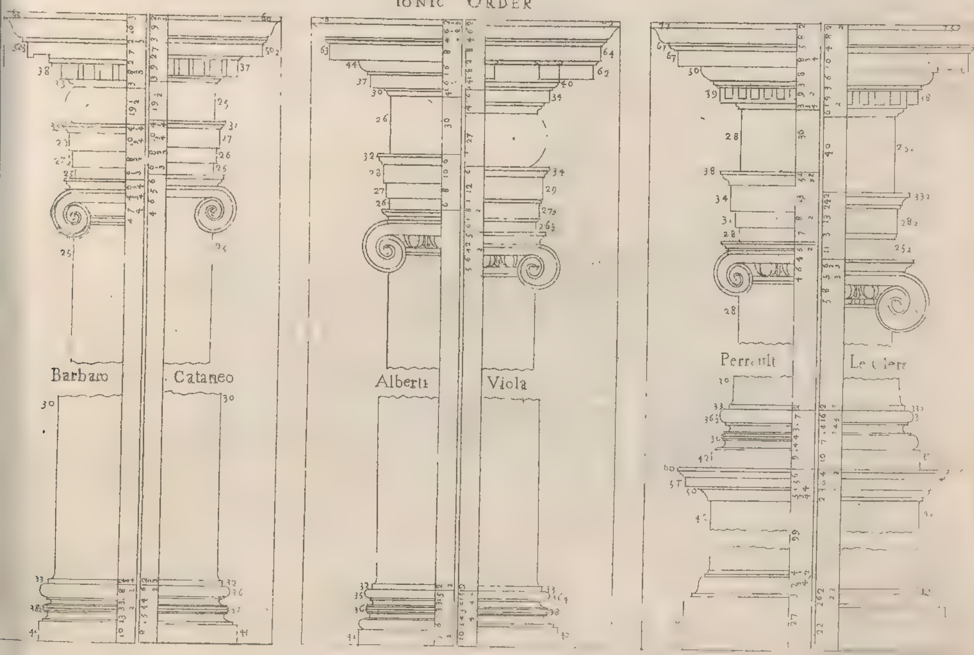

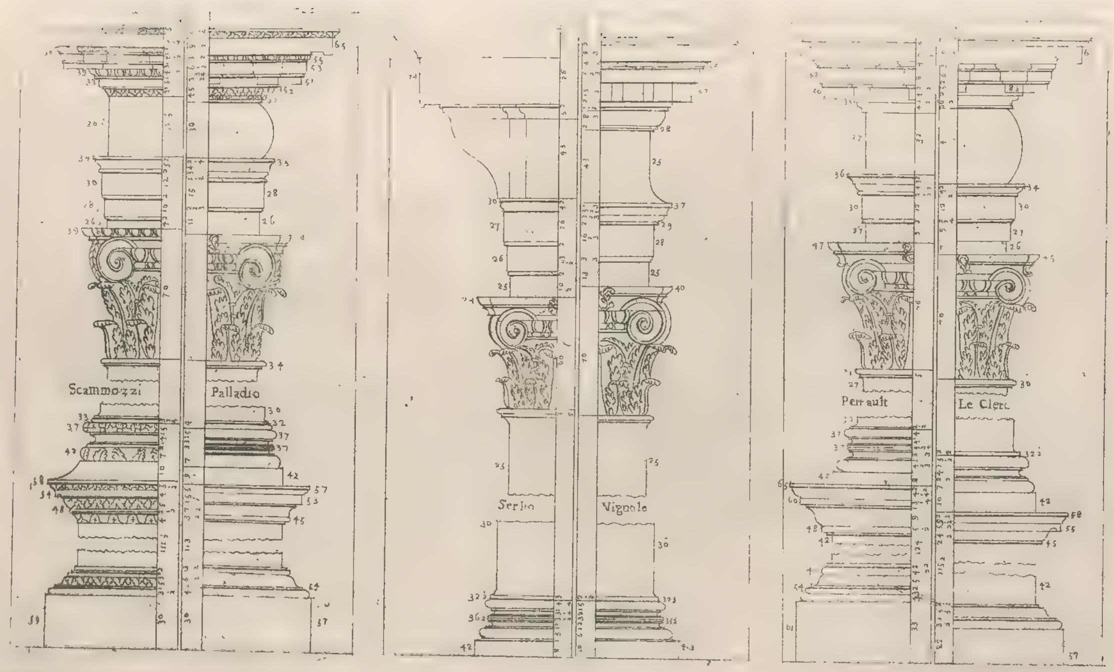
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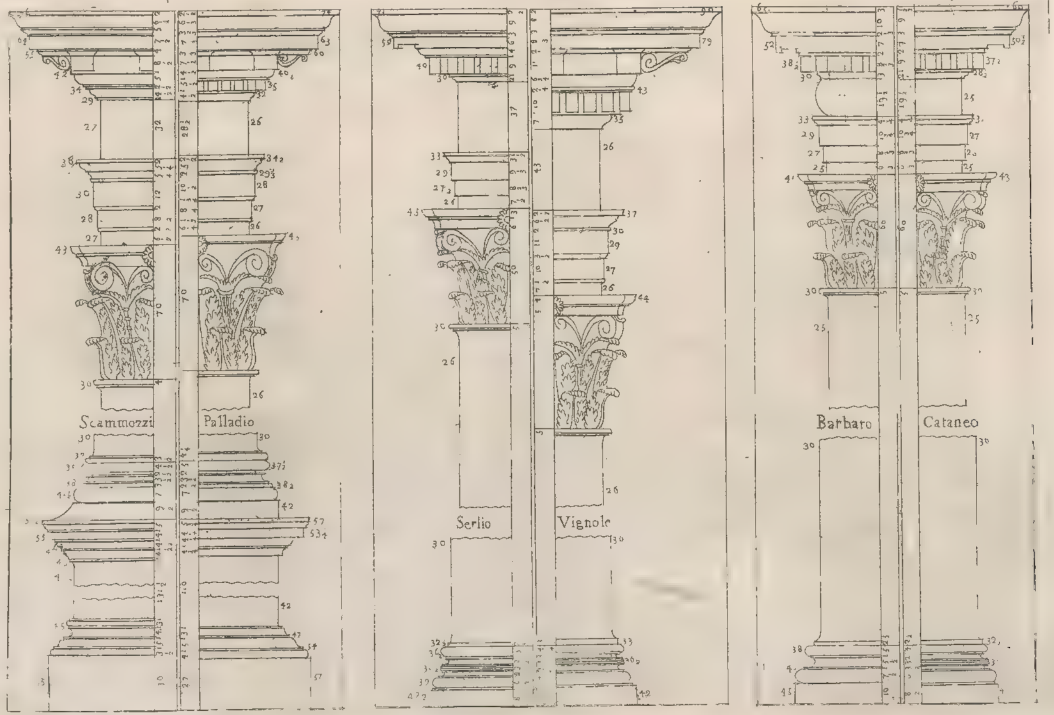
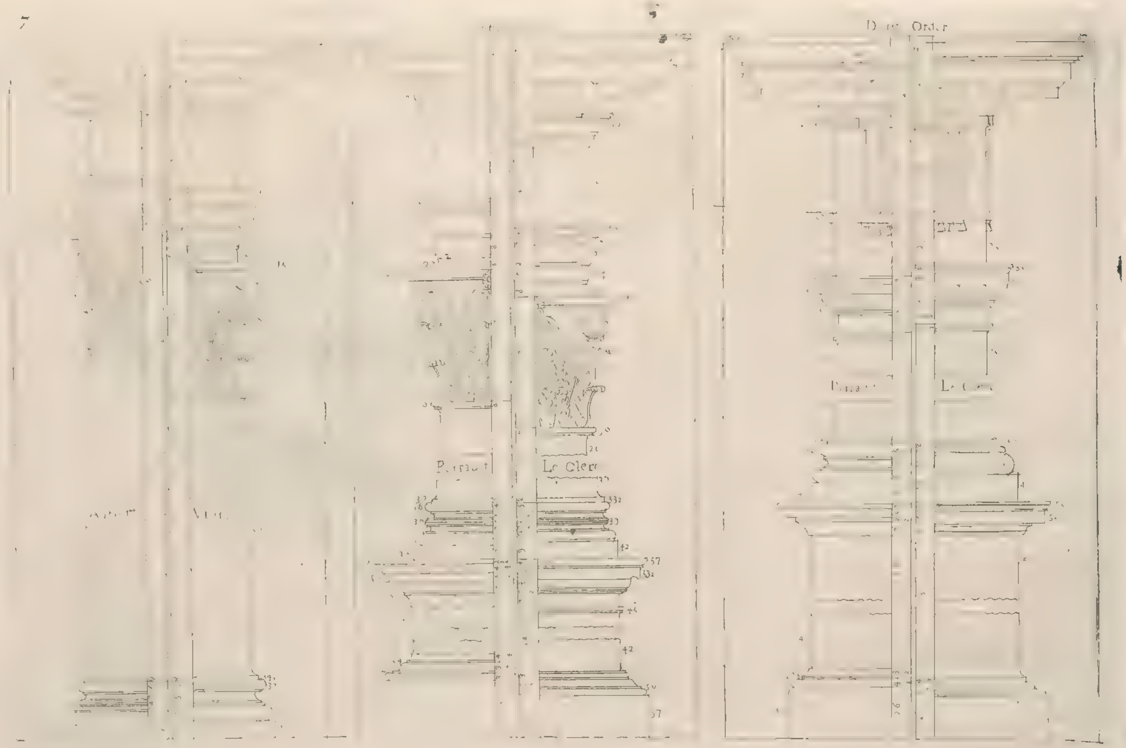
Palladio
Serlio
Vignole
Perrault
Le Clerc

Corinthian Order.

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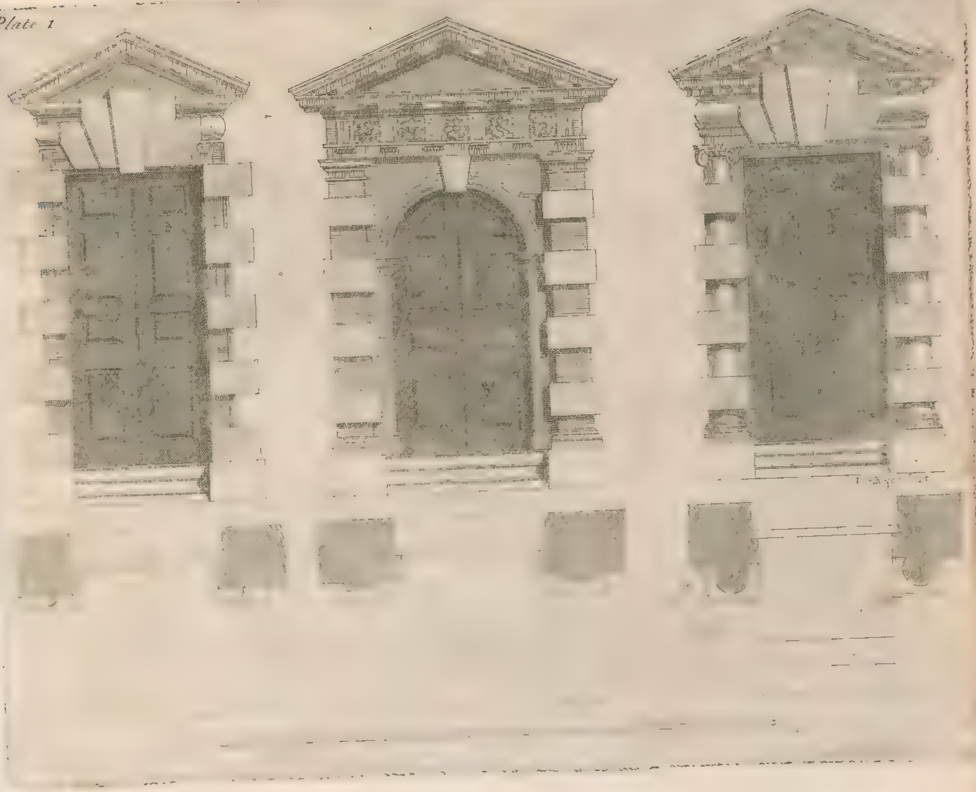

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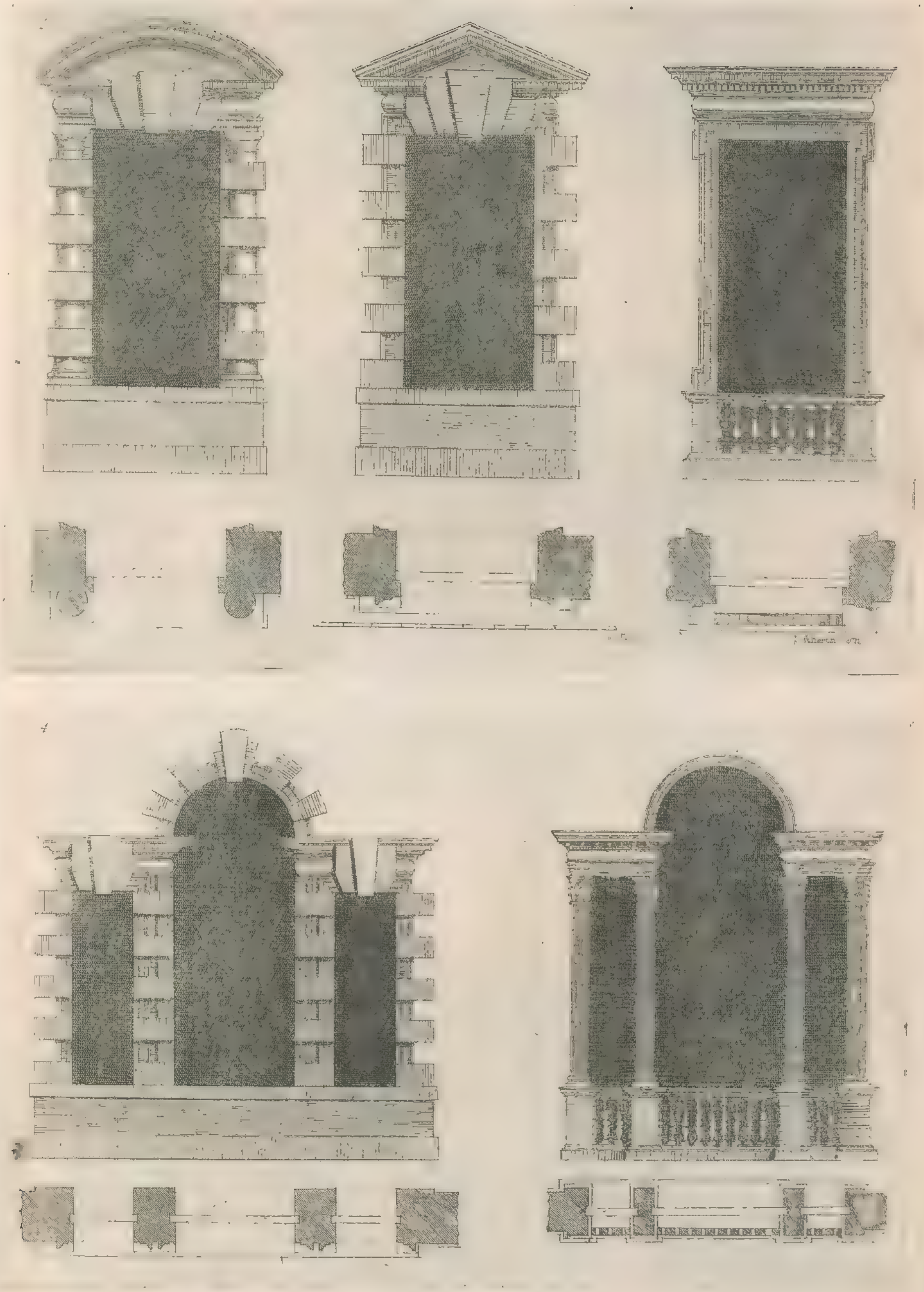

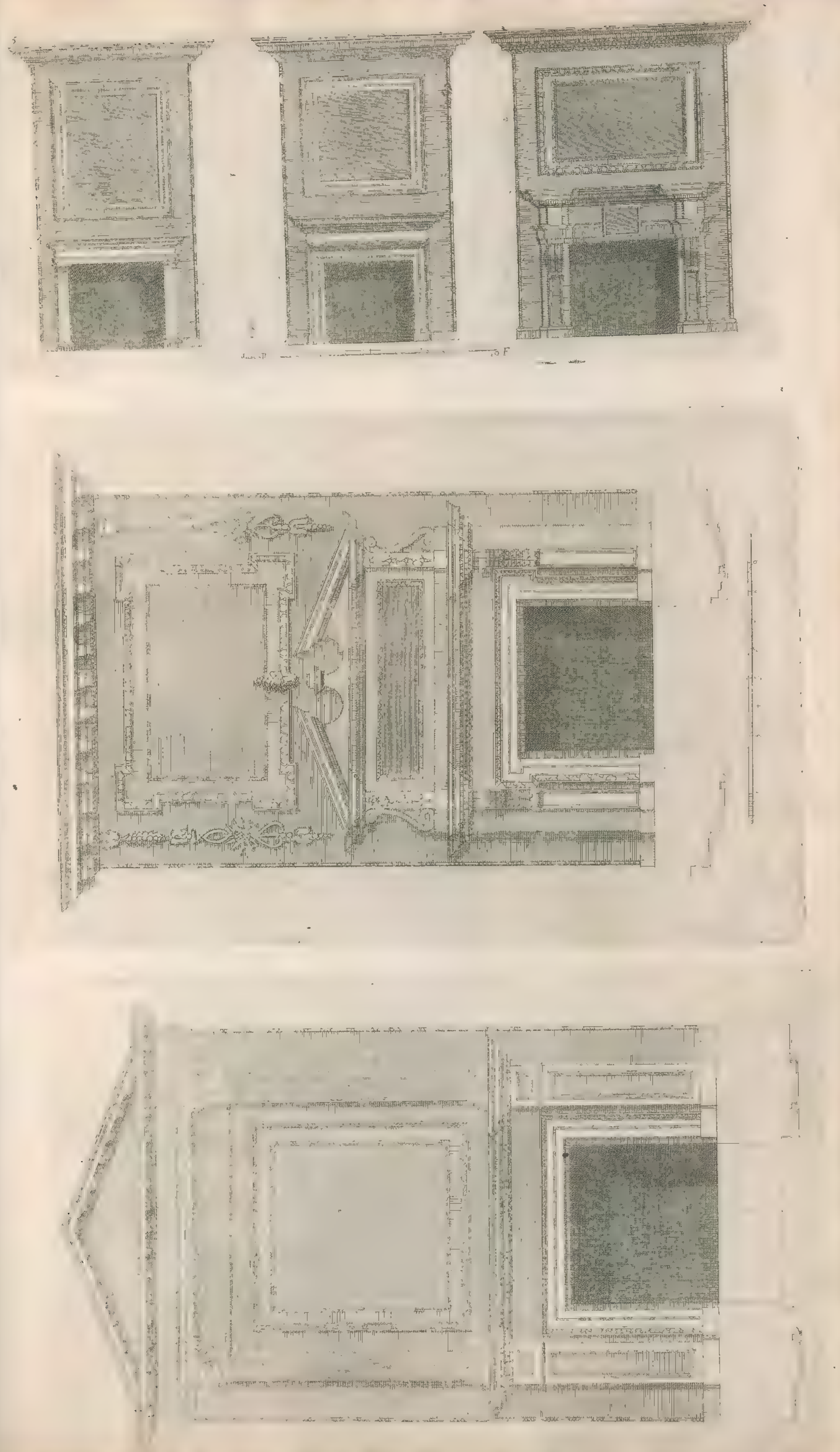
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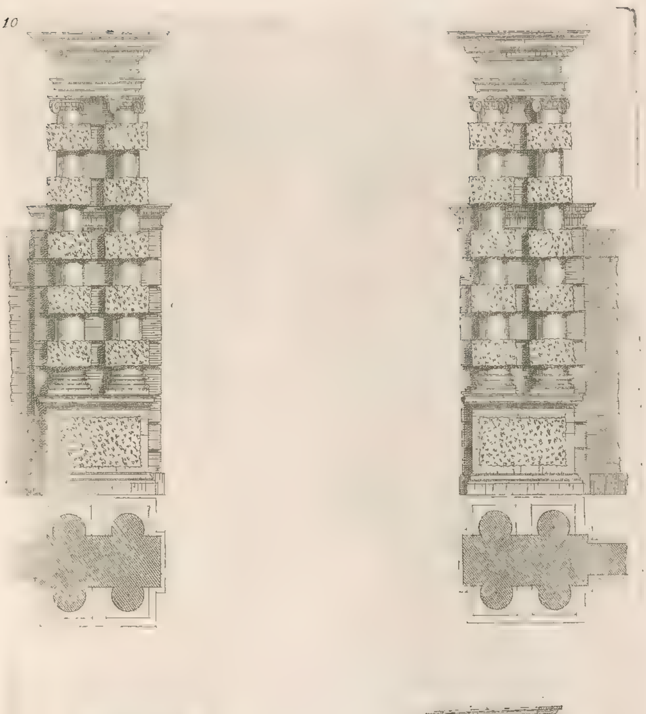

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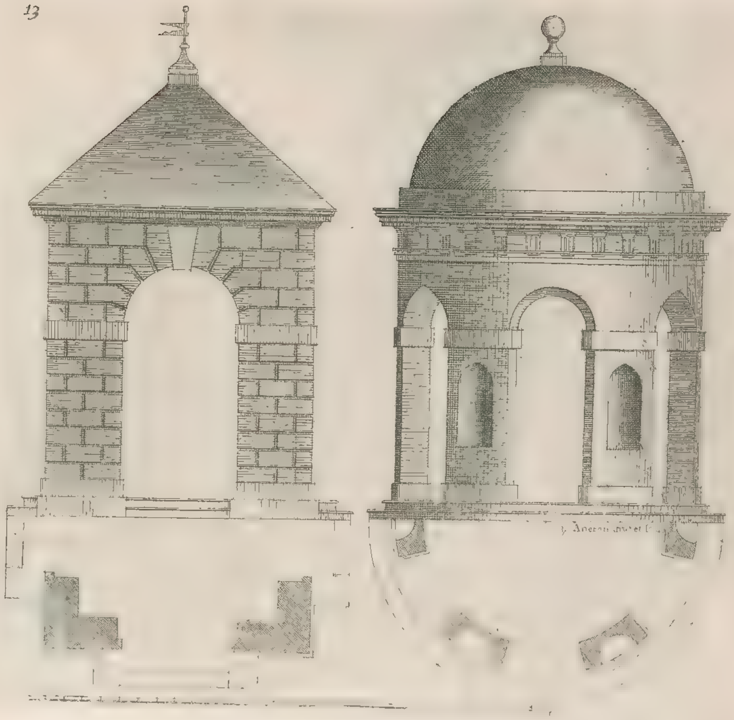

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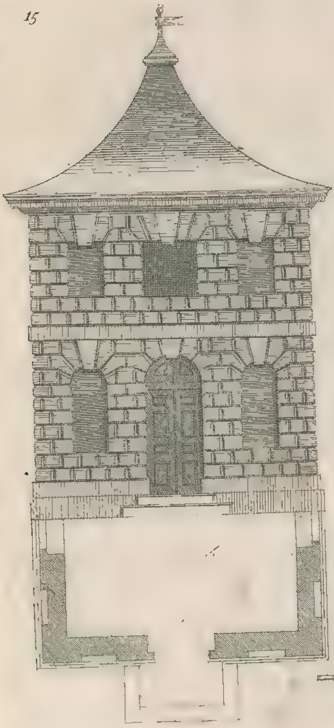

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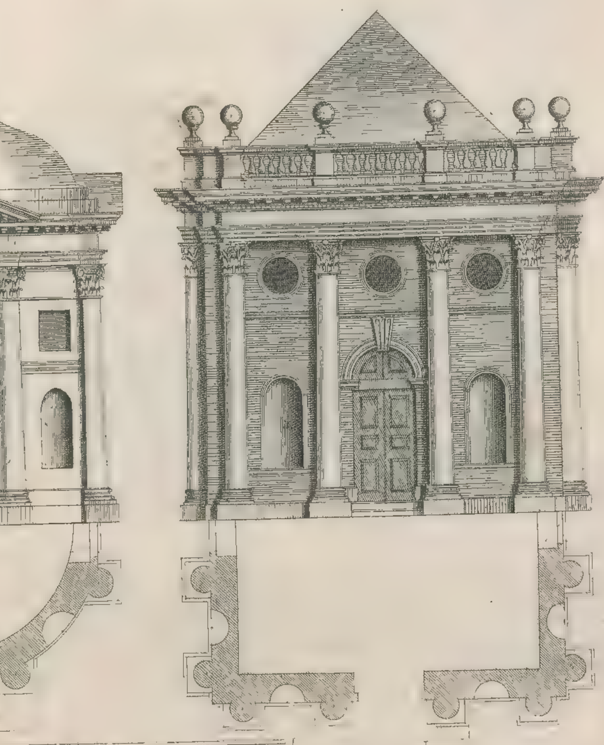

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In the following TABLE, I have given the *Reader* a Calculation of the Artificers Works, together with the Quantity of Materials that may be sufficient for erecting the several DESIGNS in Book V. such as Timber, Stone, Brick, Lathes, and Lime; supposing the Stone Perch to be 21 Feet long, 1 Foot high, and 18 Inches broad: The Allowances I made for the Materials, are as follows.

1. Perch of Stone Wall will require 1¾ Tun Wt. of Stone, half a Barrel of Lime, and 1½ Barrel of Pit Sand.

1 Yard square of Ceiling, 25 four Foot Lathes.

5 Yards of Ceiling, or Plaistering, 1 Barrel of Lime.

I measured the Cieling and Plaistering, as range Work, supposing the Cheeks, and Soffetas of Doors and Windows, to measure as much, or very near, as the Appertures, or Opens thereof, especially where the Walls are pretty Thick, but when they are Wainscotted, and Trimmed with Timber, such as Architraves, Columns, or Pilasters, they must be measured by themselves, and deducted from the Plaistering, and Chimnies also.

Two Barrels of River, or Sea Sand, will require one Barrel of Lime.

Plans.	Walling.	Roofing.	Flooring.	Ceiling Joists	Plaistering.	Ceiling.	Paving.	Sashes.	Hewn Stone.	Timber.	Stone.	Bricks.	Lathes.	Lime.
	Per.	Sq.	Sqr.	Sqr.	Yards.	Yards.	Yards	Feet.	Feet.	Tuns.	T. Wt.	M.	Ms. C.	Barrels.
1	240	9	9	5	371	106	00	60	32	10	420	090	2 7	215
2	377	16	12	7	437	156	32	101	38	14	659	111	3 9	306
3	363	13	4	4	358	116	93	135	34	9	635	136	2 9	276
4	466	29	26	13	612	400	130	437	142	23	815	175	10 0	435
5	440	25	18	13	512	300	32	240	39	23	770	165	7 5	382
6	730	17	31	10	995	350	00	462	40	30	1277	274	8 7	634
7	640	19	26	9	773	300	00	240	40	23	1120	240	7 5	536
8	1080	43	40	20	1211	465	21	520	1680	43	1840	408	11 6	875
9	608	24	15	12	713	313	132	235	212	23	1064	228	7 8	509
10	901	21	34	13	698	540	158	400	210	39	1576	238	13 5	697
11	1540	24	44	22	1416	730	243	710	1220	49	2695	578	18 2	1199
12	1610	29	57	23	1490	752	259	560	720	60	2817	604	18 8	1253
13	306	14	00	11	225	124	210	280	00	7	585	115	3 1	222
14	358	28	00	12	240	140	136	430	298	15	625	134	3 5	243
15	494	24	00	14	523	155	157	480	590	13	864	186	3 8	382
16	577	18	20	10	904	423	105	500	644	22	1004	216	10 5	553
17	2046	36	10	22	1317	250	231	1520	2980	38	3580	753	6 2	1336
18	1663	33	13	28	937	320	286	1852	16560	50	2910	623	8 0	1082
22	678	18	27	13	1063	425	140	441	113	30	1186	254	10 6	636
23	986	31	44	21	1620	680	480	585	1679	52	1725	372	17 0	953
24	1291	58	85	28	1427	1268	317	931	186	98	2259	484	31 7	1184
25	1270	47	55	27	2030	920	307	837	1700	75	2222	476	23 0	1225
26	843	33	36	18	1614	566	188	610	120	54	1475	306	14 1	857
27	960	37	67	22	1620	906	000	668	1804	72	1680	366	22 7	985
28	570	43	40	21	1204	469	28	520	400	55	997	214	11 7	610
29	739	39	52	17	1074	616	37	733	890	63	1293	277	15 4	707
30	894	33	43	16	1700	602	00	519	2338	57	757	336	15 0	307
31	1304	73	66	34	1484	800	00	1352	29800	95	2282	489	20 0	1108
32	1840	40	118	40	2957	1864	466	1528	12854	140	3220	690	46 6	1884
33	880	27	48	15	1184	666	177	882	1852	63	1540	330	16 6	810
34	1487	51	70	25	1690	1043	260	954	2239	85	2602	558	26 0	1289
35	914	43	23	23	1082	600	257	500	000	46	1599	343	15 0	793
36	2591	68	110	21	2586	1080	363	1411	42	139	4284	959	27 5	1832
38	2834	59	78	26	2650	1222	305	1300	11600	118	4959	1063	30 5	2191
41	2843	65	106	41	2960	1800	400	1376	15546	140	4975	1066	45 0	2373
44	1856	47	126	38	2022	1261	000	1449	9640	158	3248	696	31 5	1584
46	1945	44	79	46	2940	1237	354	1577	13276	105	3403	729	30 9	1884
48	3965	103	156	53	3644	1797	32	1360	20680	239	6938	1587	44 9	3070
50	1727	72	72	35	2773	1200	945	1301	4890	121	3022	648	32 0	1654
52	3049	84	129	45	4876	1850	451	1513	23450	181	5335	1143	46 2	2869
54	2690	63	112	45	3894	1693	500	1624	19670	153	4707	1009	42 3	2462
57	3402	98	171	52	4433	2433	580	2532	26400	220	5953	1276	60 8	3074
60	2046	102	129	62	3270	2755	688	1180	6200	201	3580	768	68 8	2228
61	4028	120	252	80	8210	3377	844	3448	28210	885	7049	1511	84 4	4331
63	11452	187	267	112	8341	4266	1233	3738	35500	419	20041	4295	101 6	8247
66	14620	320	515	260	11776	8337	3150	5240	40560	951	25385	5483	208 4	11234
69	6513	210	280	114	10014	4200	1020	5024	59400	469	11347	2442	105 0	5998
71	8180	214	355	140	11311	5076	1684	5040	46450	530	1[illegible]315	3658	126 9	7363
73	11756	245	709	236	15863	7155	1788	8700	78600	1108	20563	4409	178 8	10481
76	17300	129	245	126	8681	3200	1065	4066	35410	477	3027[illegible]	[illegible]488	80 0	11226
81	36760	698	891	270	35840	9750	3124	10608	158480	2151	64330	13785	243 7	27498
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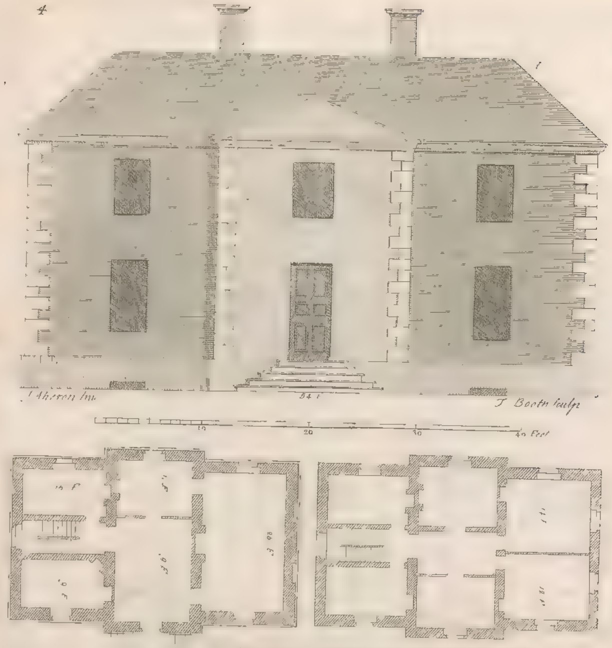
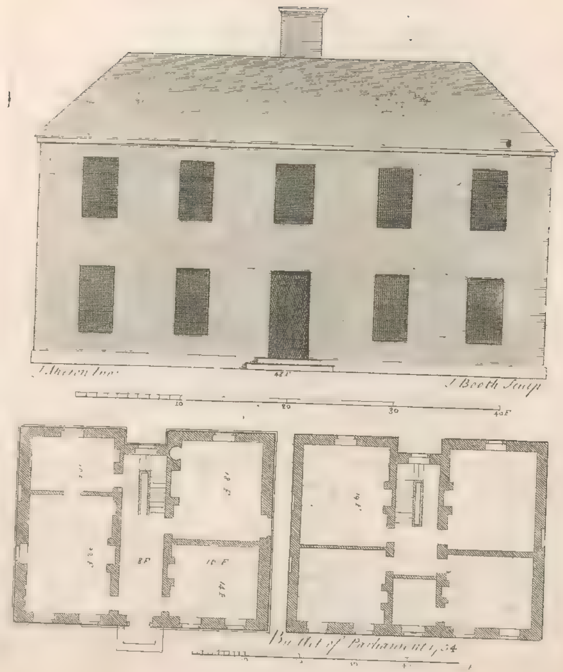
3

4



By Act of Parliament 1774

5



By Act of Parliament 1774

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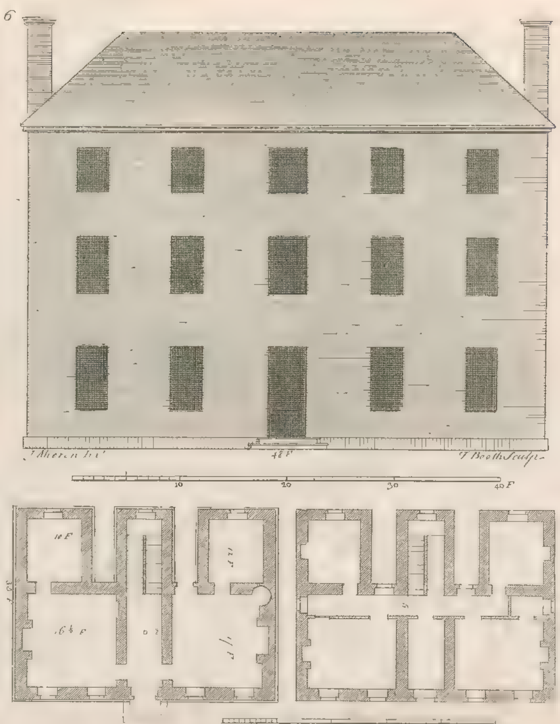
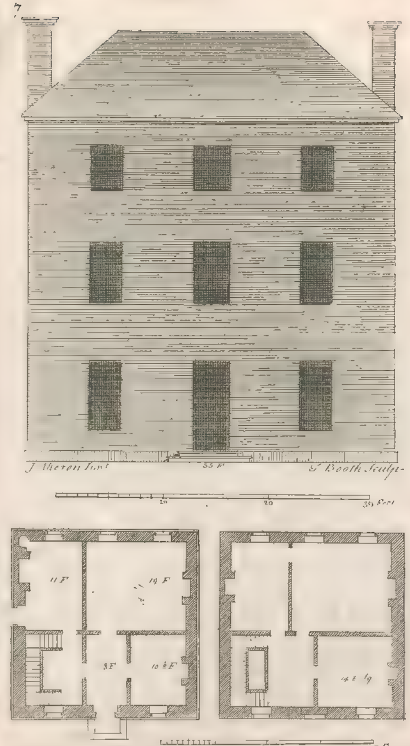


By Act of Parliament 1754

7



By Act of Parliament 1754

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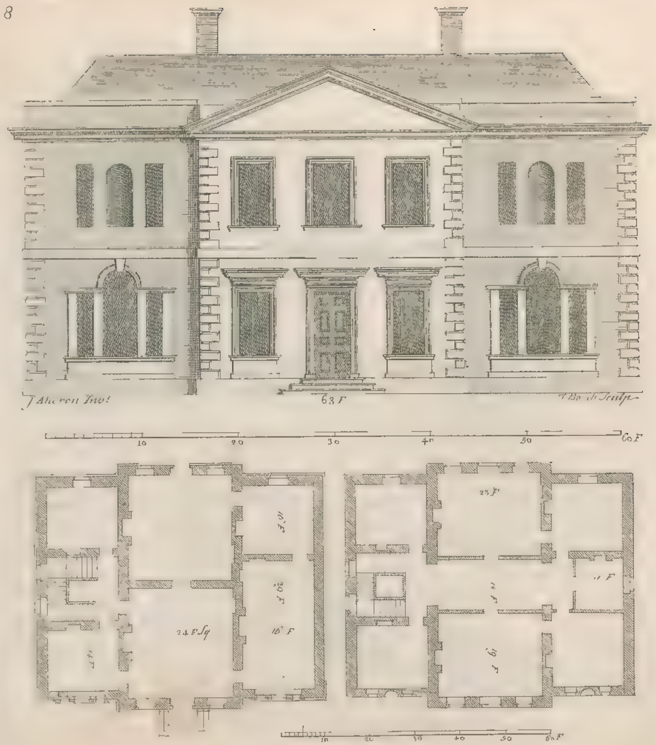
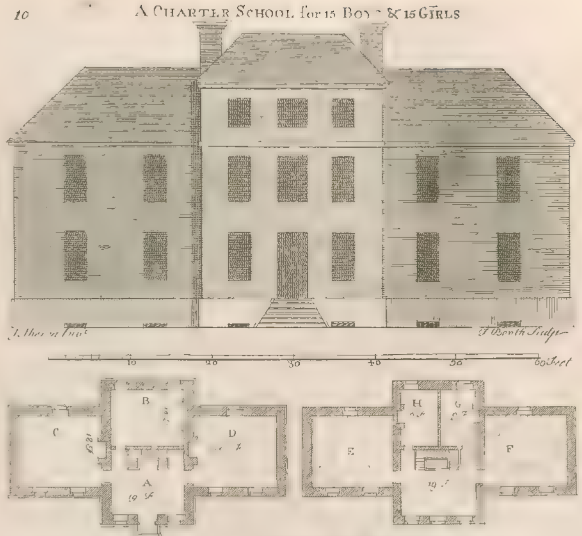


By Act of Parliament 1754

A C   SCHOOL for 20 BOYS

By Act of Parliament 1754

10 A CHARTER SCHOOL for 15 BOYS & 15 GIRLS



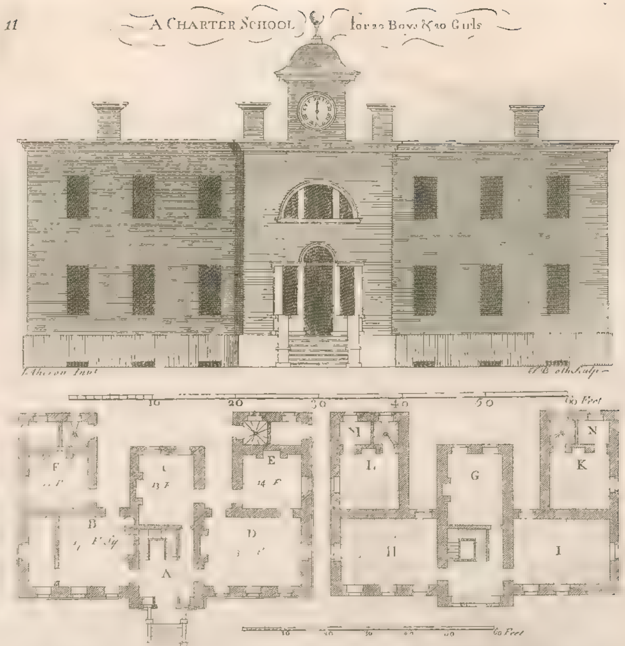
A The Hall
B Master's Room
C Boys School Room

D. Girls School Room
E Boys Bed Chamber

F Girls Bed Chamber
G Mistress's Bed Chamber
H Master's Bed Chamber

By Act of Parliament 1754

11 A CHARTER SCHOOL for 20 Boys & 20 Girls



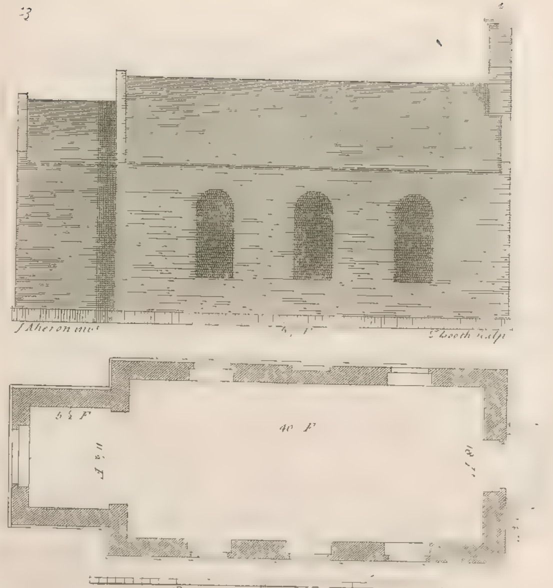
A The Hall
B Kitchen
C Girls School Room
D Boys School Room

E Master's Room
F Brew house
G Mistress's Room

H Boys Bed Chamber
I Girls Bed Chamber
KL Infirmaries
MN Closets

By Act of Parliament 1754

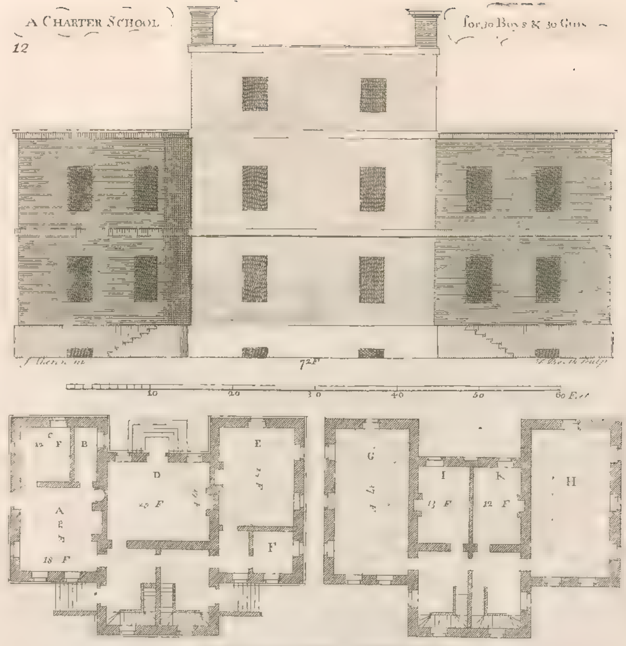
13



By Act of Parliament 54

A CHARTER SCHOOL for 30 Boys & 30 Girls

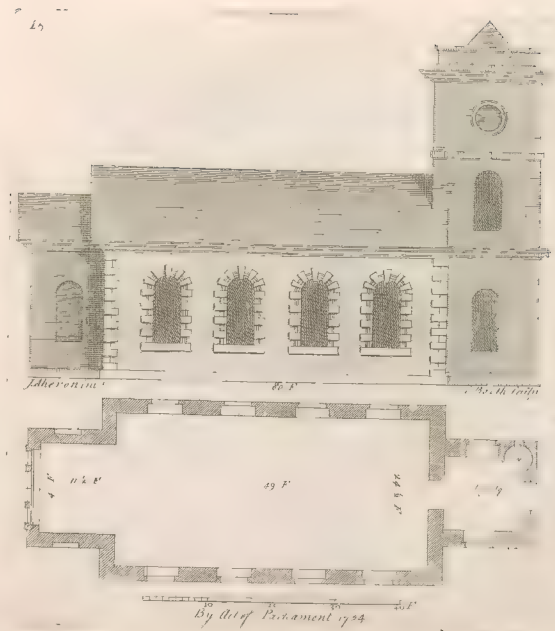
12



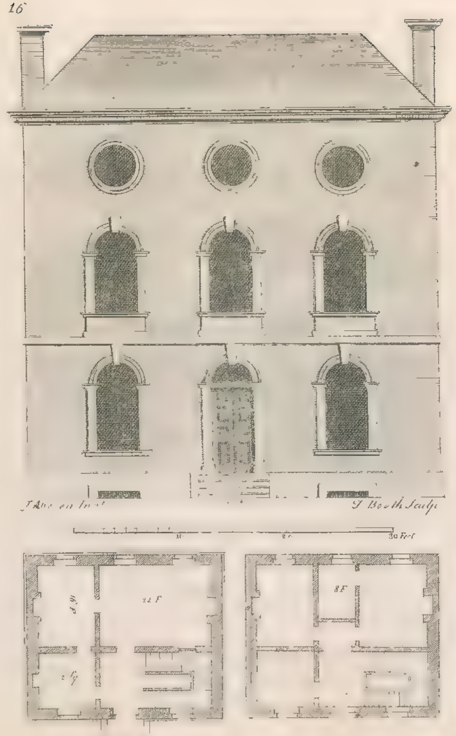
A Kitchen
B Larder
C Dairy
D Boys School Room
E Girls School Room
F
G Boys Bed Chamber
H
I
K

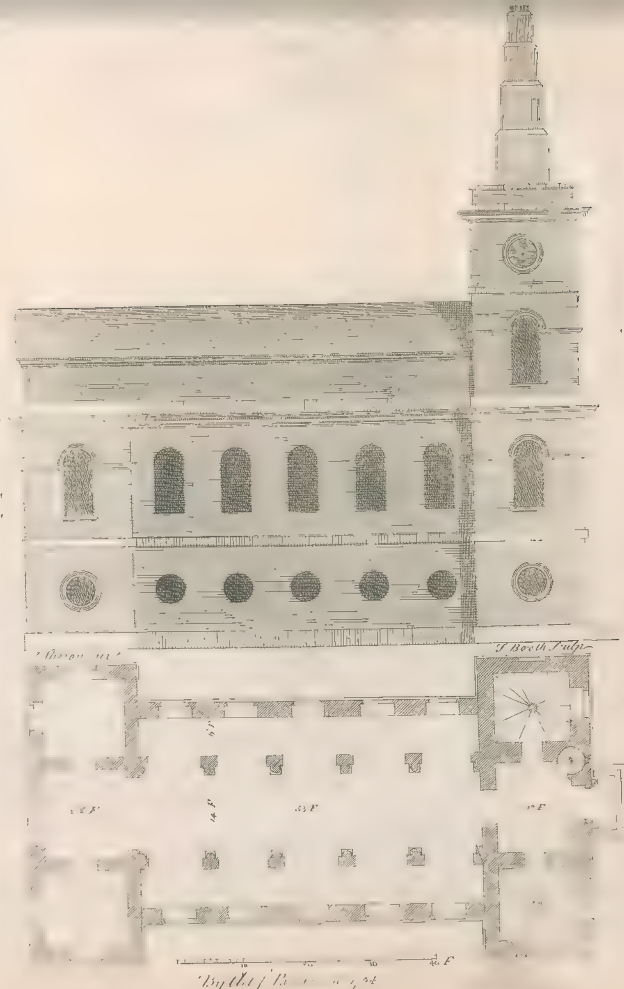
By Act of Parliament 54

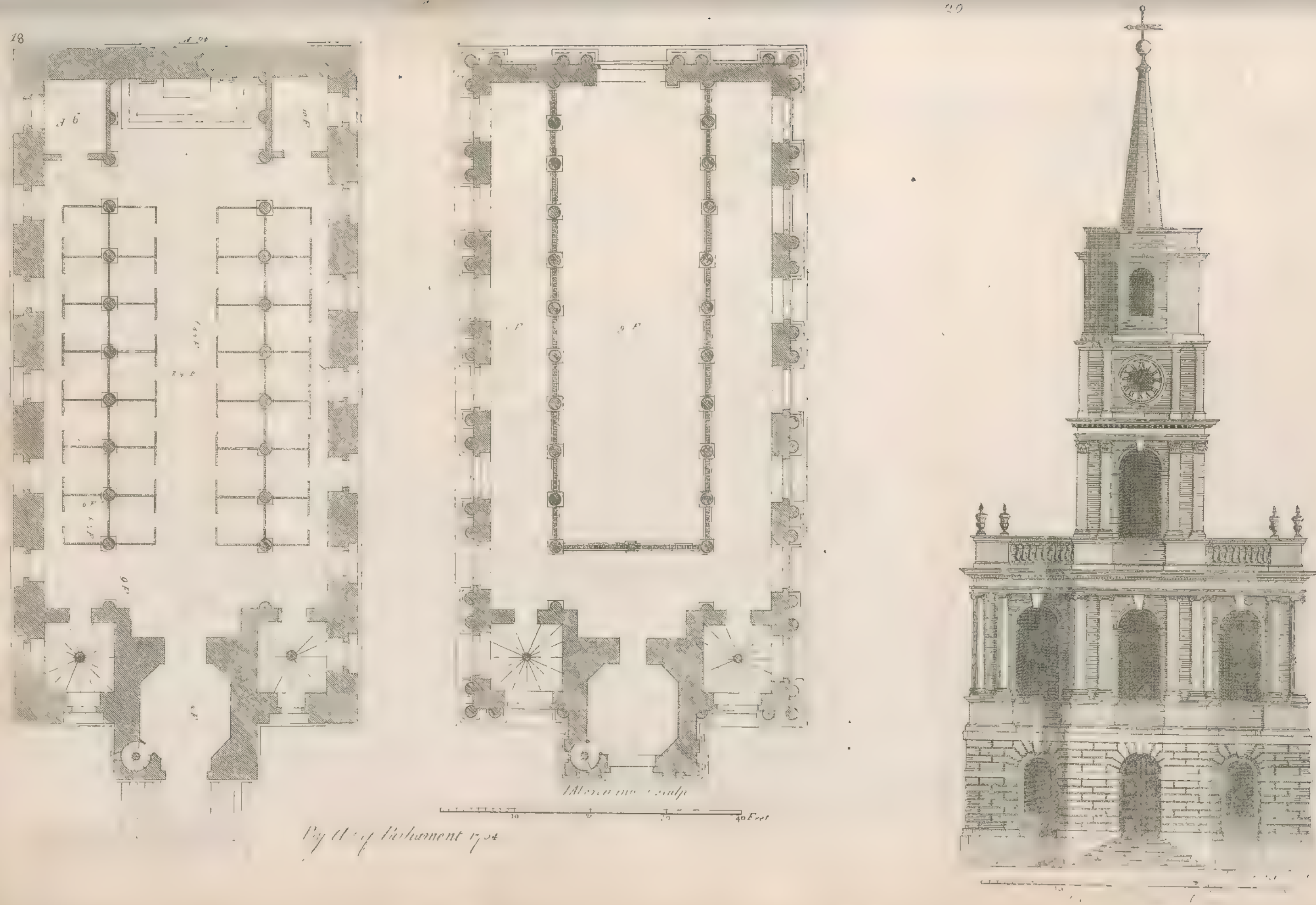

14
10
20
30
40 F
61 F
48 F
20 F
14 F
8½ F
By Act of Parliament 1734


80 F
49 F
24½ F
11½ F
By Act of Parliament 1734

16





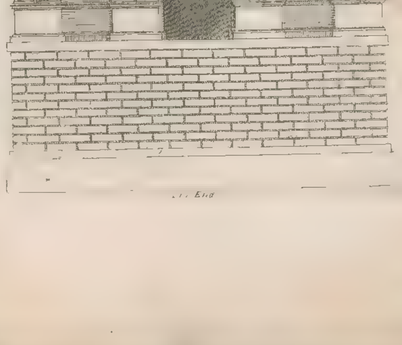

18
29
10
40 Feet
By Act of Parliament 1734

19

By Act of Parliament 1754

10 20 30 40 F

21



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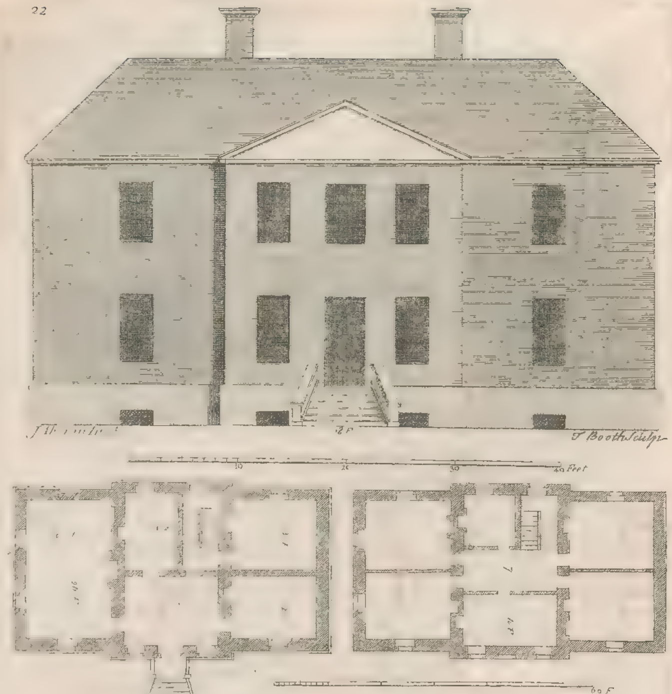

By Act of Parliament 1754

23

By Act of Parliament 1754

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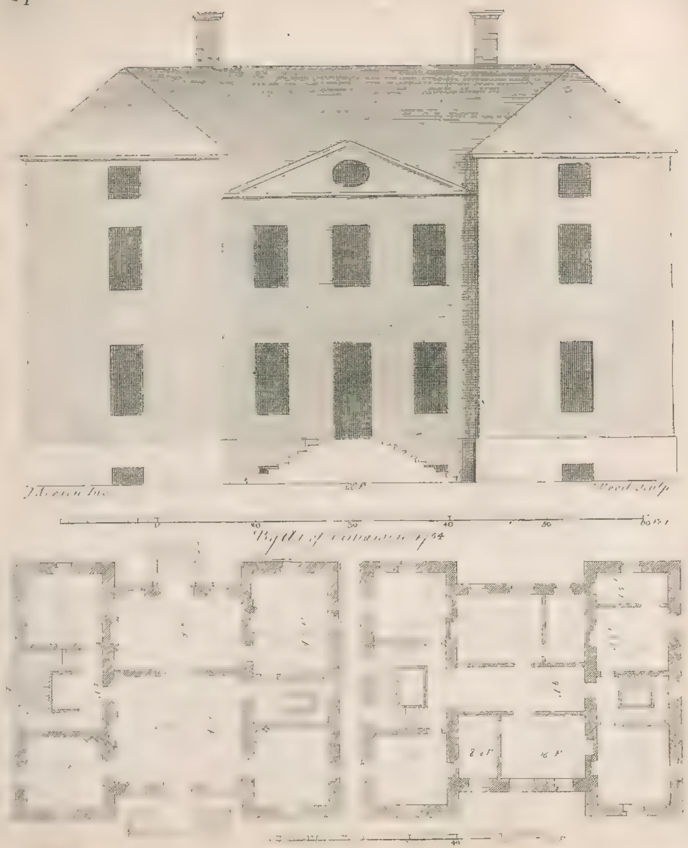

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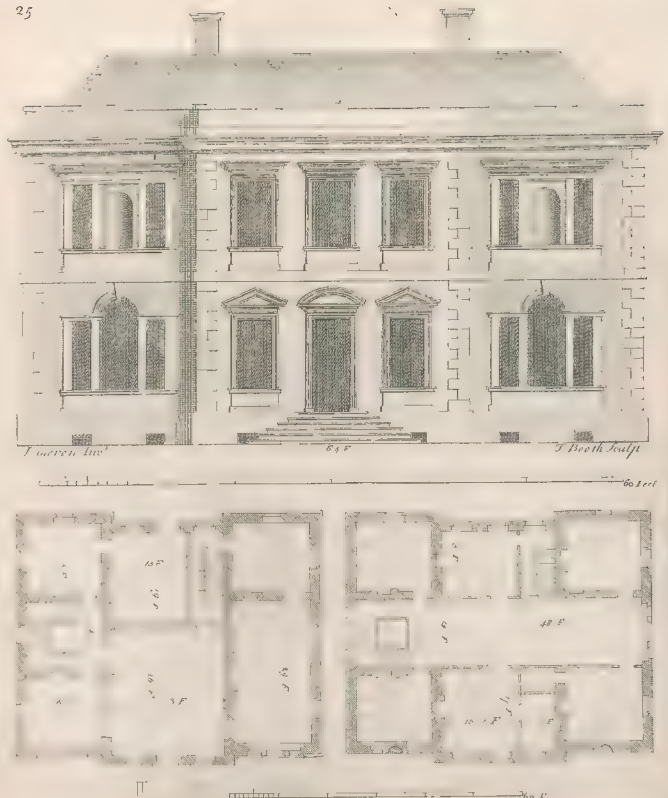

By Act of Parliament 1754

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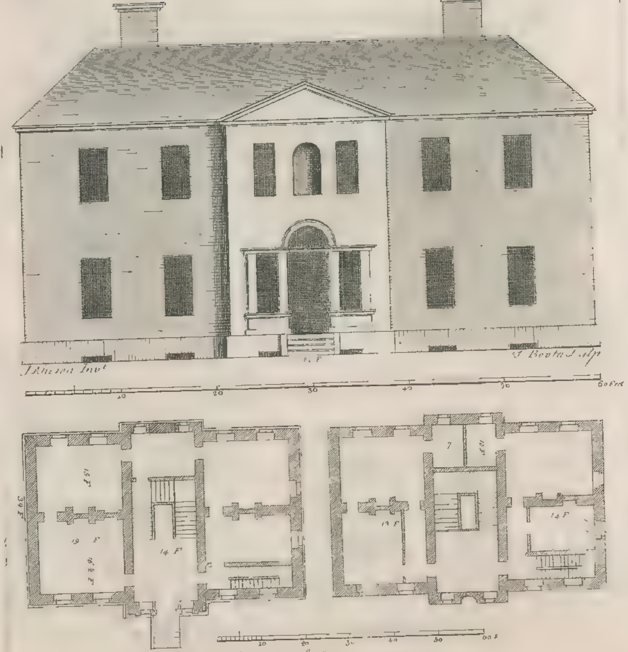

By Act of Parliament 1754

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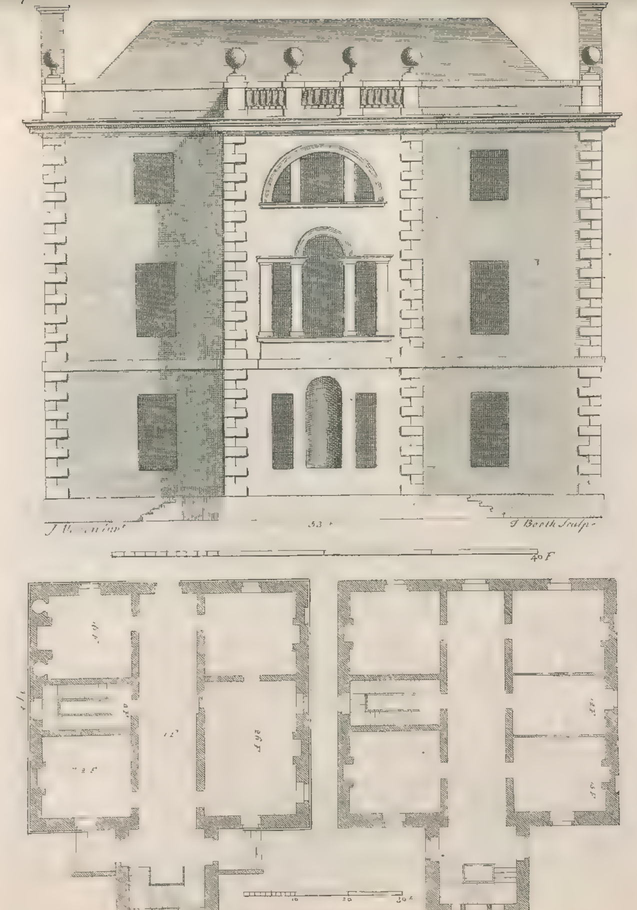

By Act of Parliament 1754

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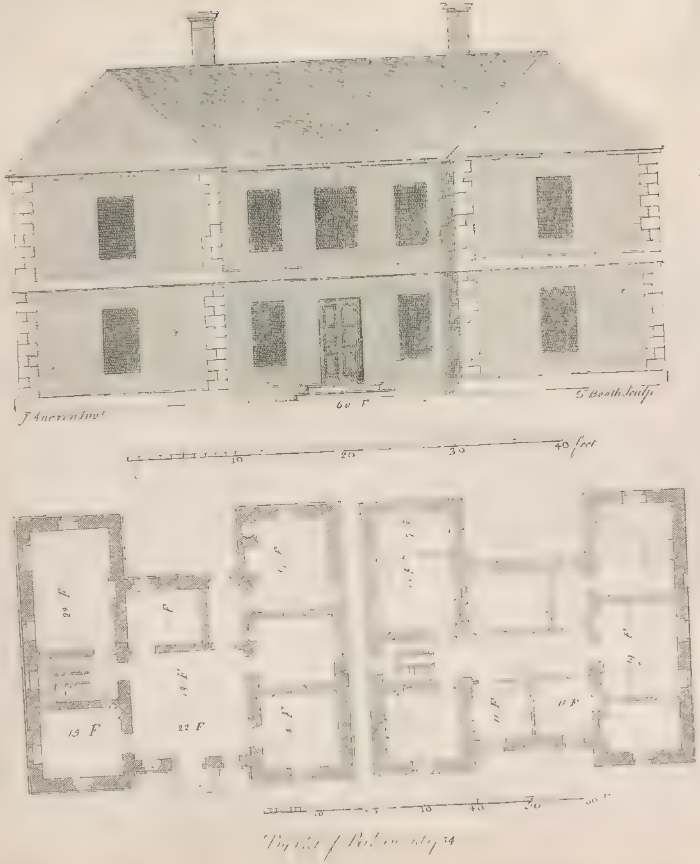

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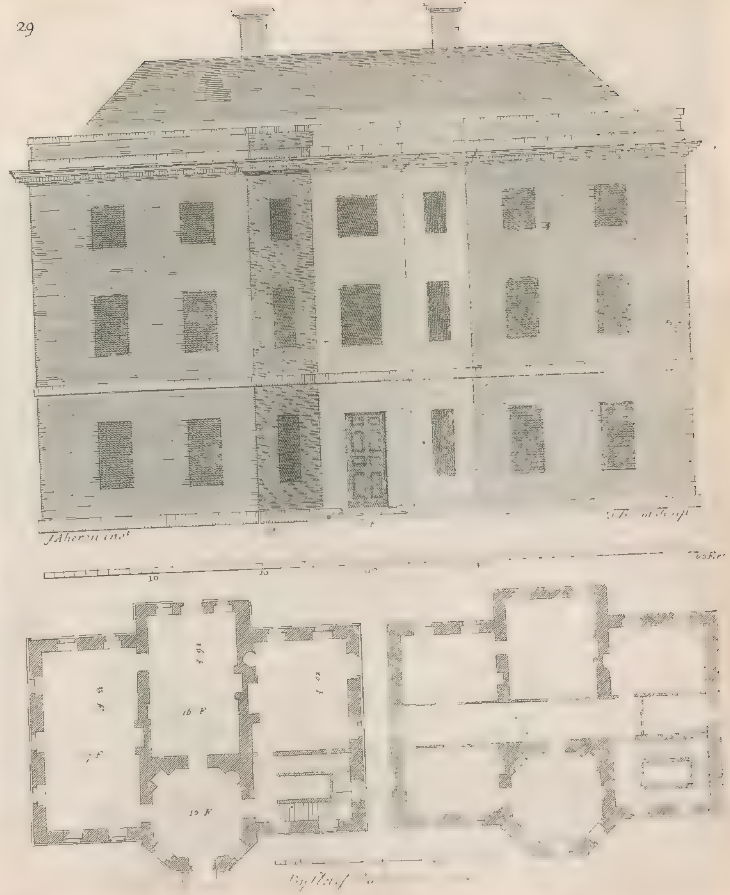

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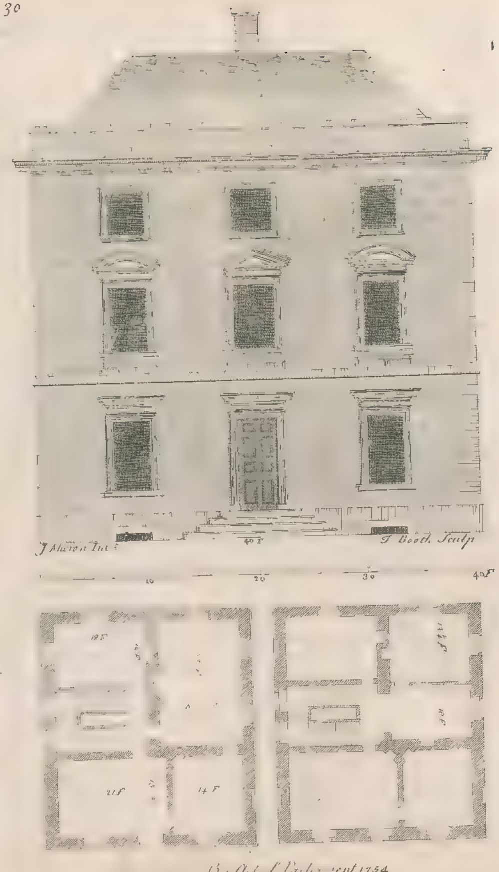
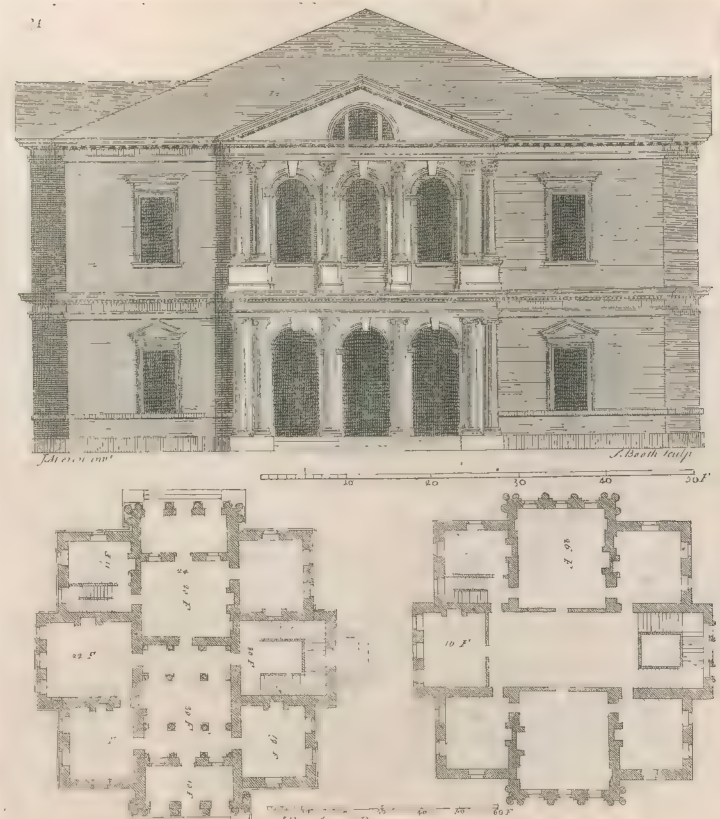


J Marion Inv. — J Booth Sculp

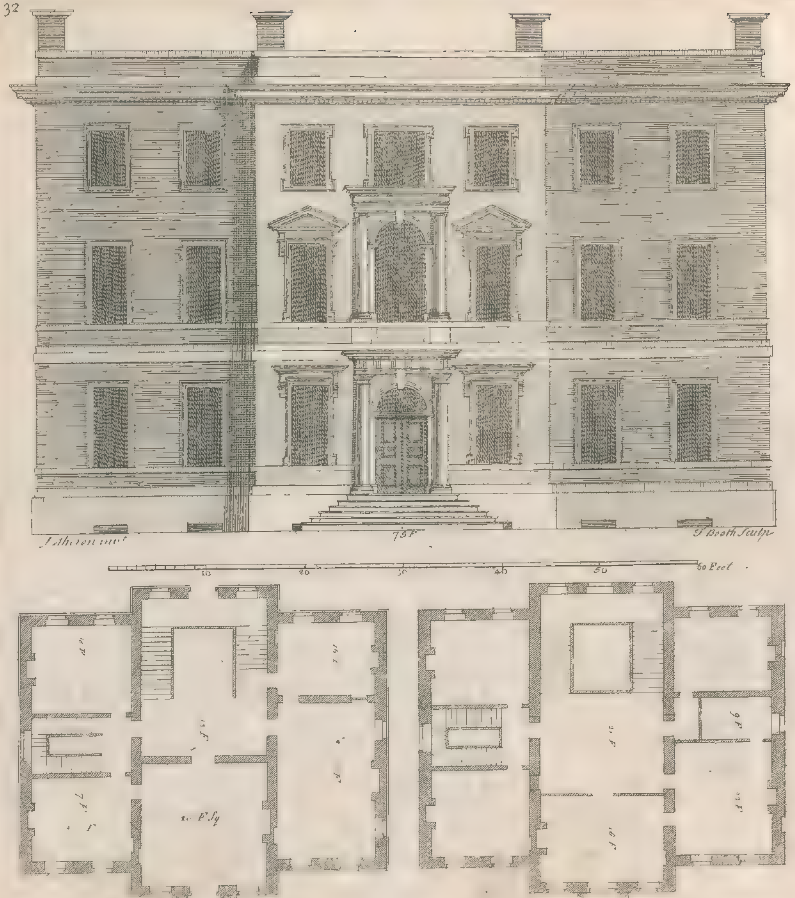
By Act of Parliament 1754

31



J Marion inv. — J Booth Sculp

32


J Athorn inv
75 F
J Booth Sculp
10
20
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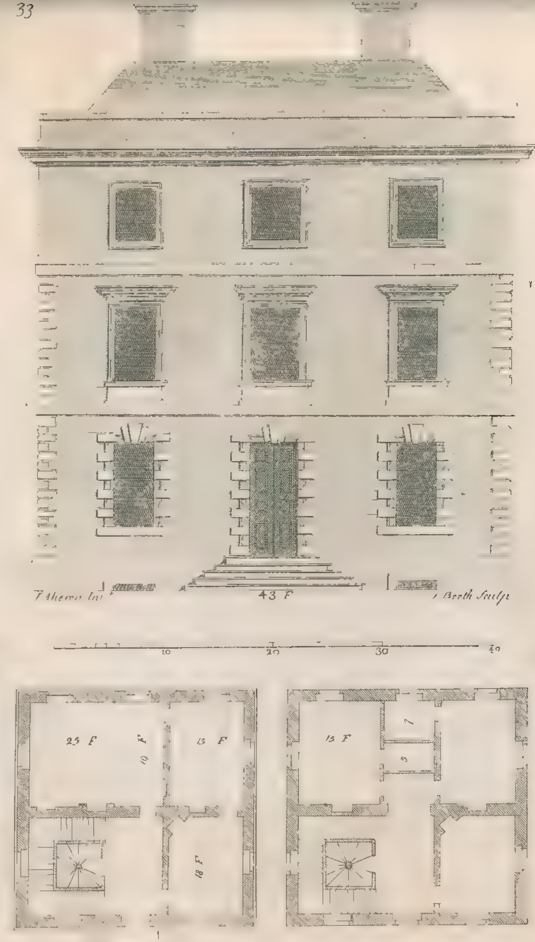
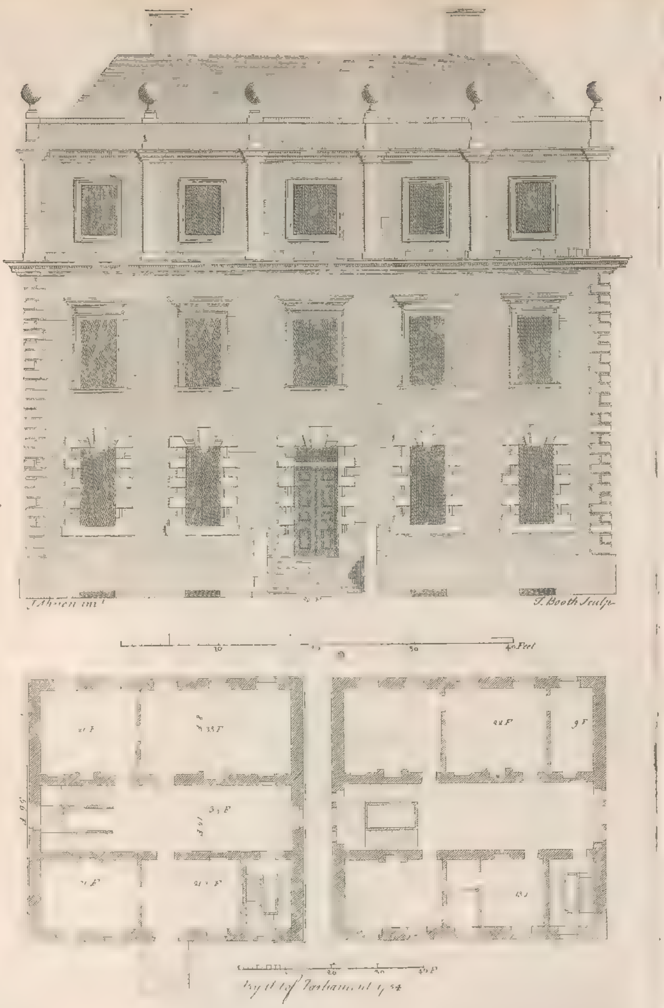
40
50
60 Feet
9 F
21 F
16 F
12 F
7 F
F Sq

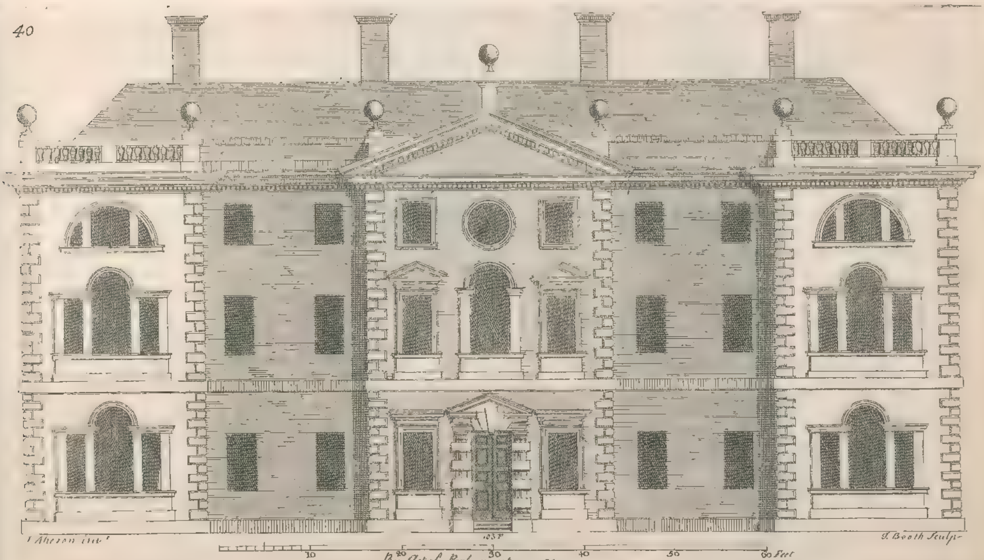
33

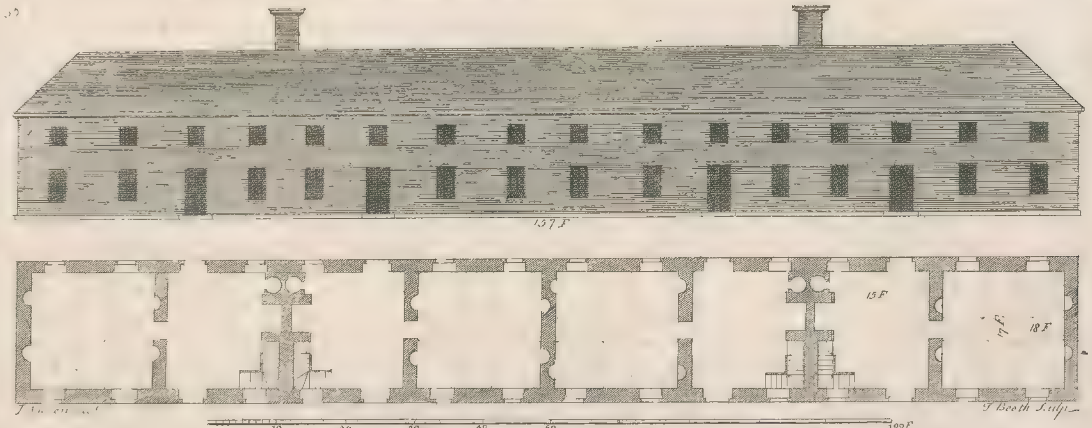

J Athorn Inv
43 F
J Booth Sculp
10
20
30
40
25 F
10 F
13 F
18 F
15 F
7
5
30 F

34


J. Aheron inv.
T. Booth Sculp.
By Act of Parliament 1754

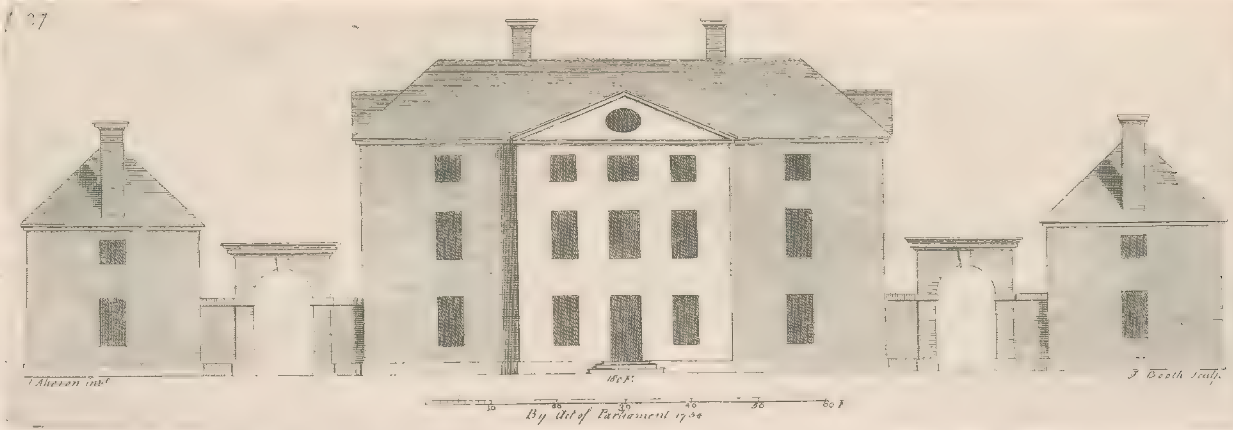
40


J. Aheron inv.
T. Booth Sculp.
By Act of Parliament 1754

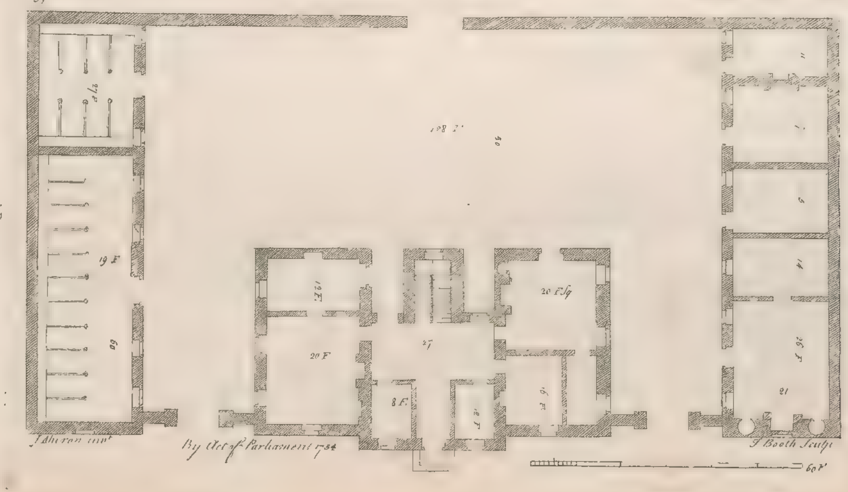


By Act of Parliament 1734

37


J. Aheron inv^t
18 F.
By Act of Parliament 1754
J. Booth sculp.

36


27 F
19 F
60
19 F
20 F
8 F.
27
18 F
16 F
20 F Sq
108 F
40
11
5
14
26 F
21
J. Aheron inv^t
By Act of Parliament 1754
J. Booth Sculp.
60 F

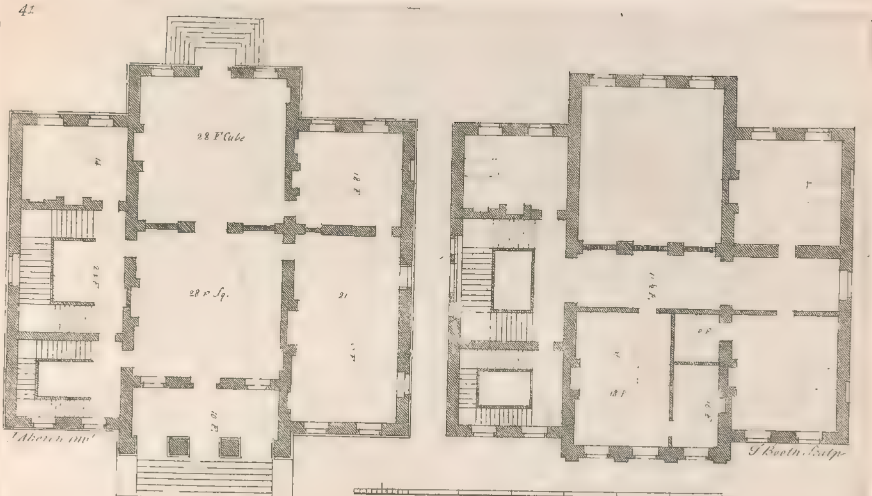
39


J Aheron inv.
T Booth Sculp
By Act of Parliament 1754
60 F

38

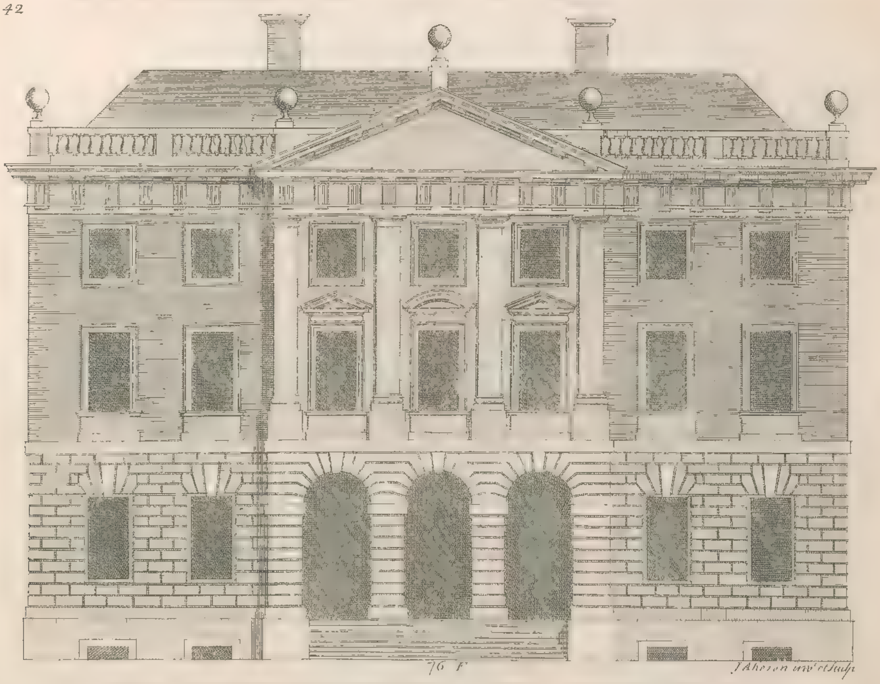

J Aheron inv.
T Booth Sculp
By Act of Parliament 1754
80 F

41



By Act of Parliament 1734

42

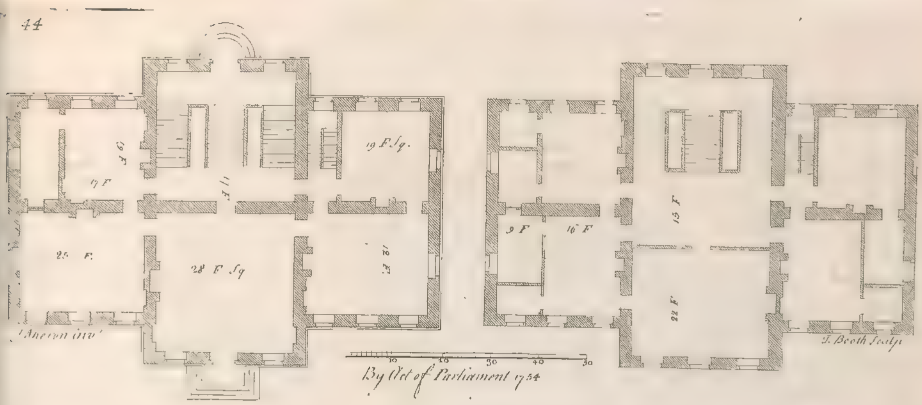


the Main Front of y^e foregoing Plan

43

[illegible] foregoing [illegible]

44

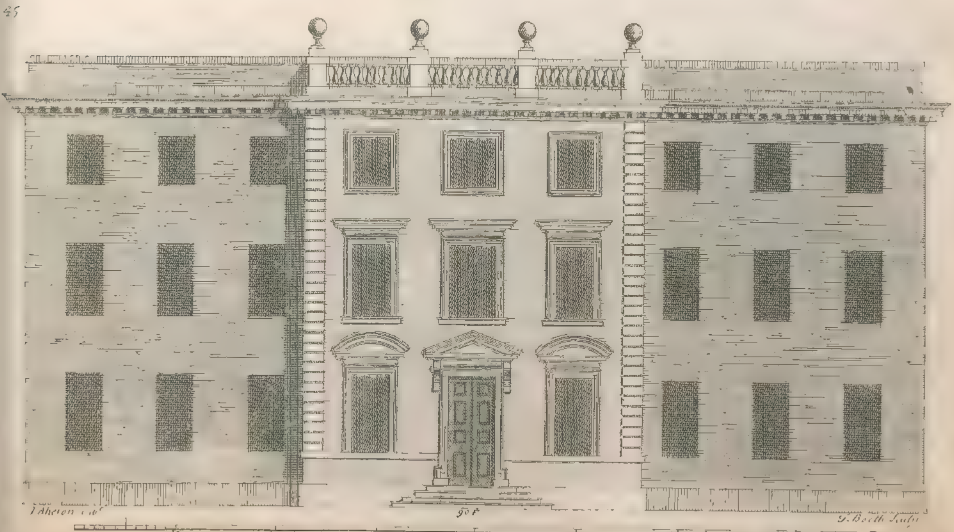


T. Aheron inv.

T. Booth Sculp.

By Act of Parliament 1754

45

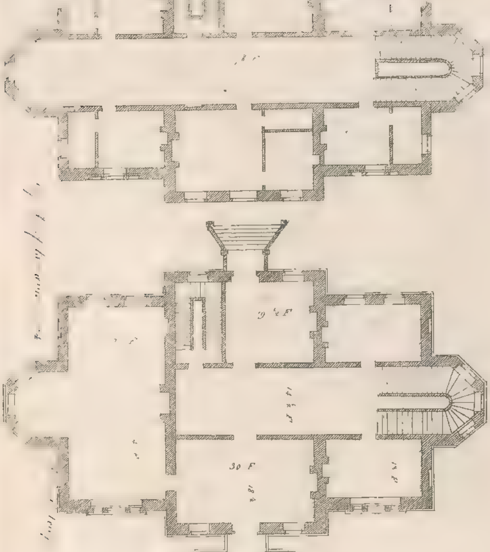


T. Aheron del.

T. Booth Sculp.

the Front of y^e foregoing Plan

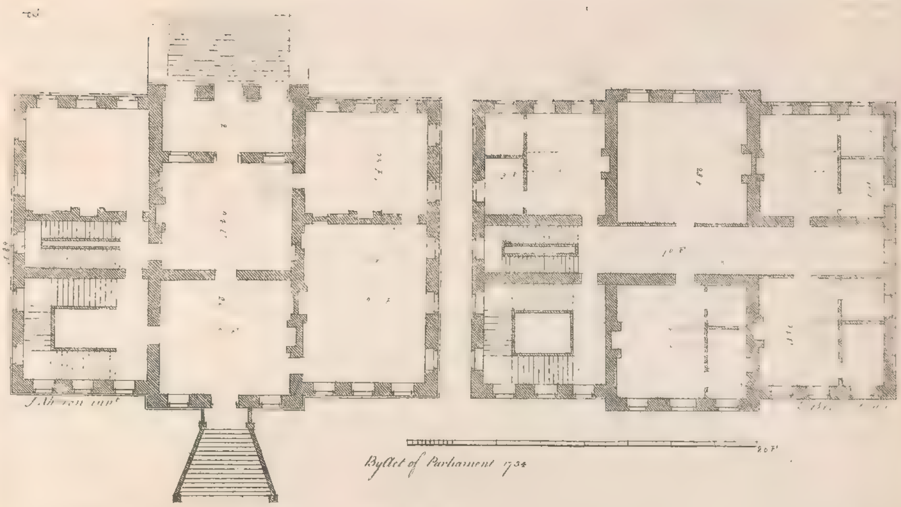
7



J. Aheron inv.t

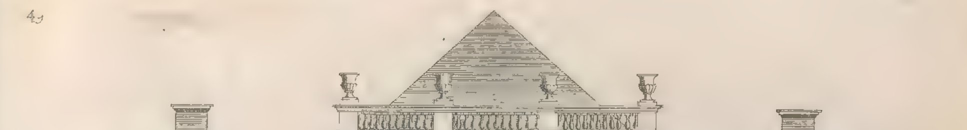
the Main Front of ye foregoing Plan

T. Booth sculp.



By Act of Parliament 1734

49



the Main Front of y^e foregoing Plan

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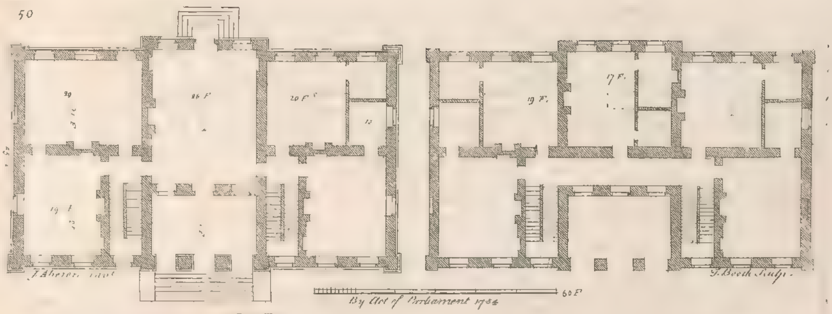


J. Aheron inv.

J. Booth Sculp.

By Act of Parliament 1754

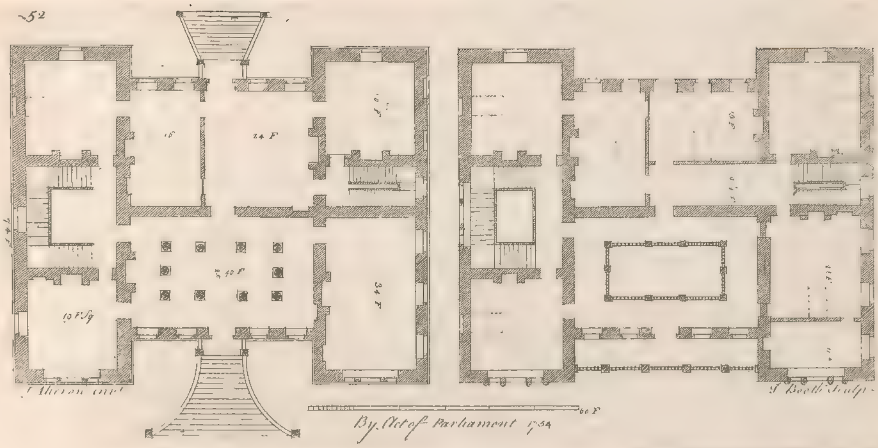
51

J. Aheron inv.

J. Booth Sculp.

the Main Front of ye foregoing House

52



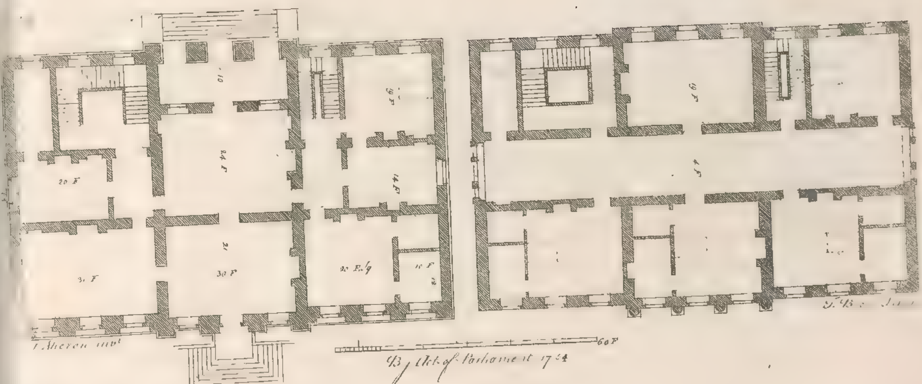
J. Aheron inv.t J. Booth Sculp.

By Act of Parliament 1754

53

J. Aheron inv.t et Sculp.

the Front of y.e foregoing Plan



J. Aheron inv.

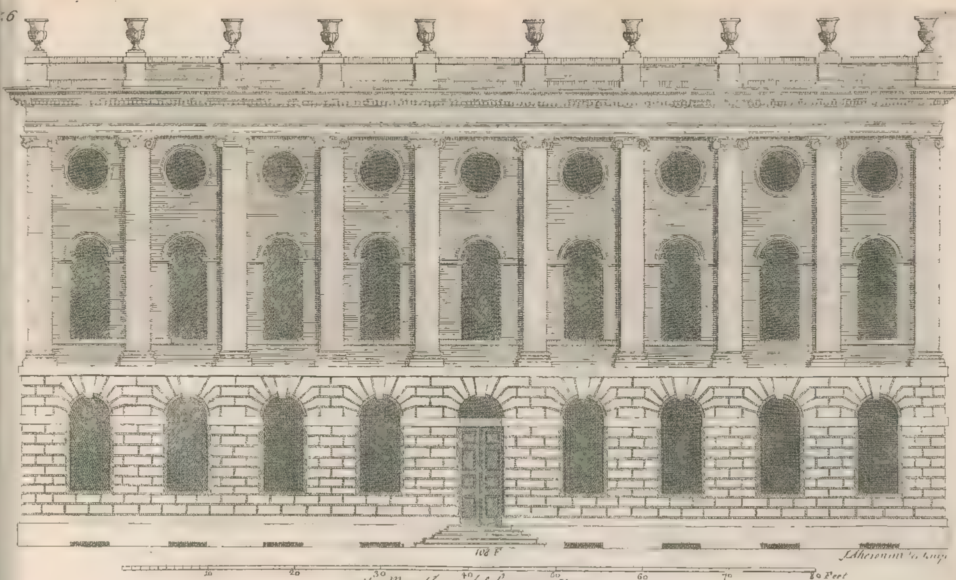
By Act of Parliament 1754

55

J Aheron inv. J Booth Sculp

the Main Front of y^e foregoing Plan

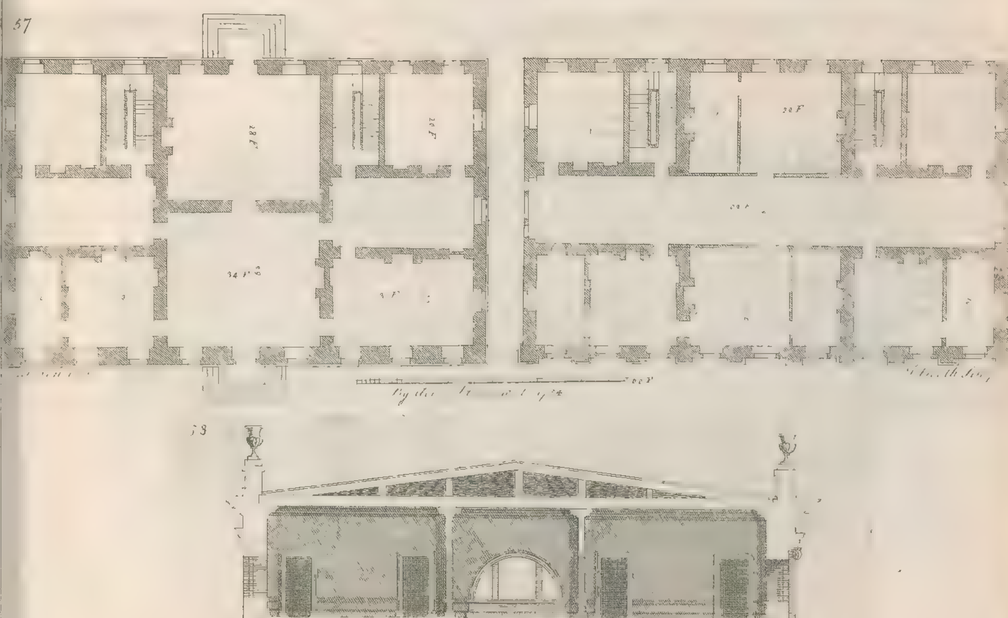
56



the Main Front of ~~y^e foregoing House~~

J. Aheron inv. et sculp.

57

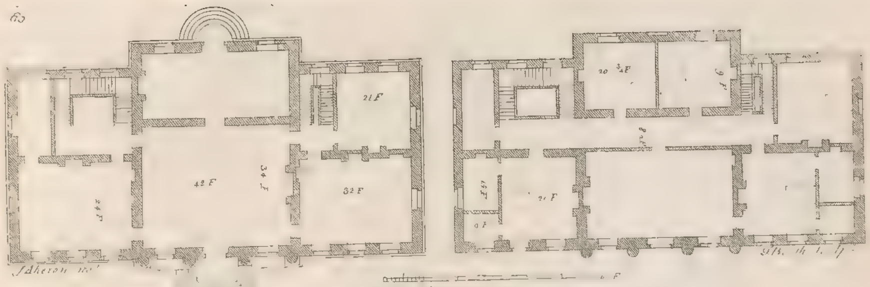


58

A Section of y^e foregoing House

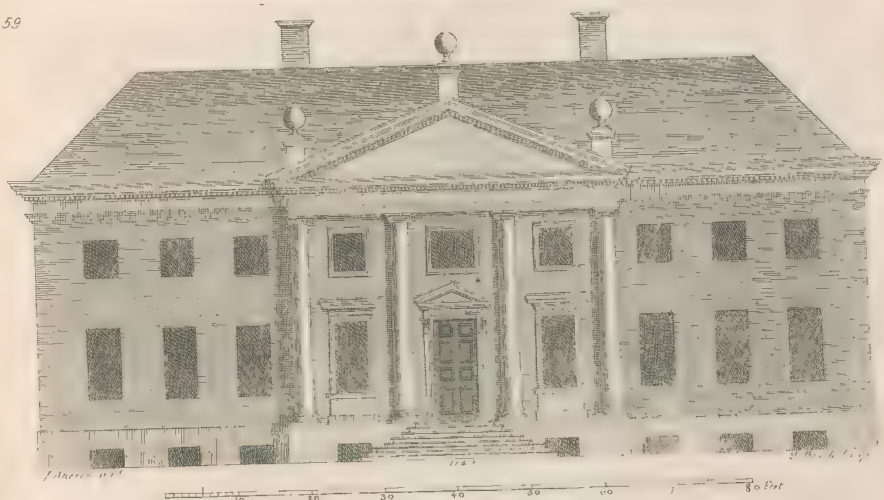
J. Aheron inv. et sculp.

60



by Act of Parliament 1754

59



the Main Front of ye foregoing House

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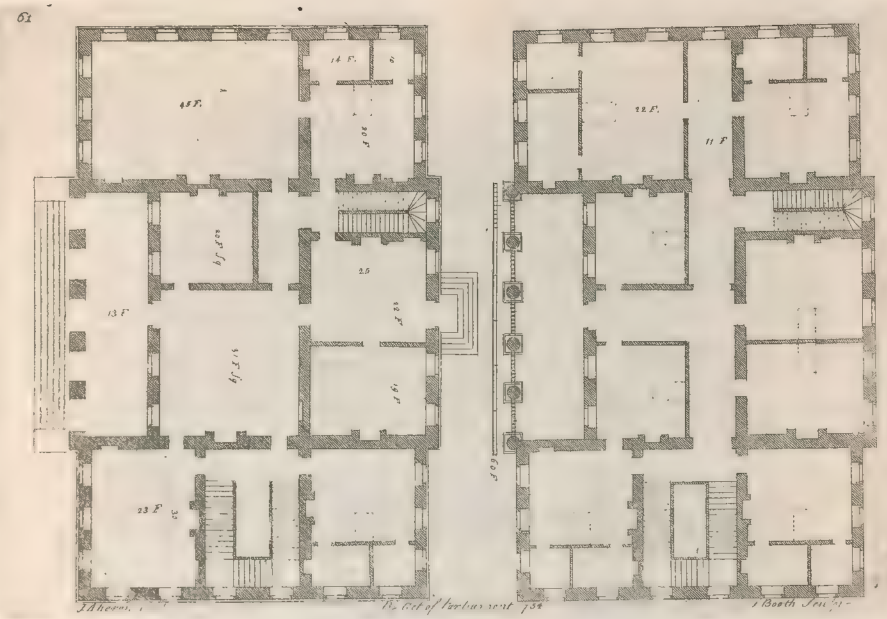

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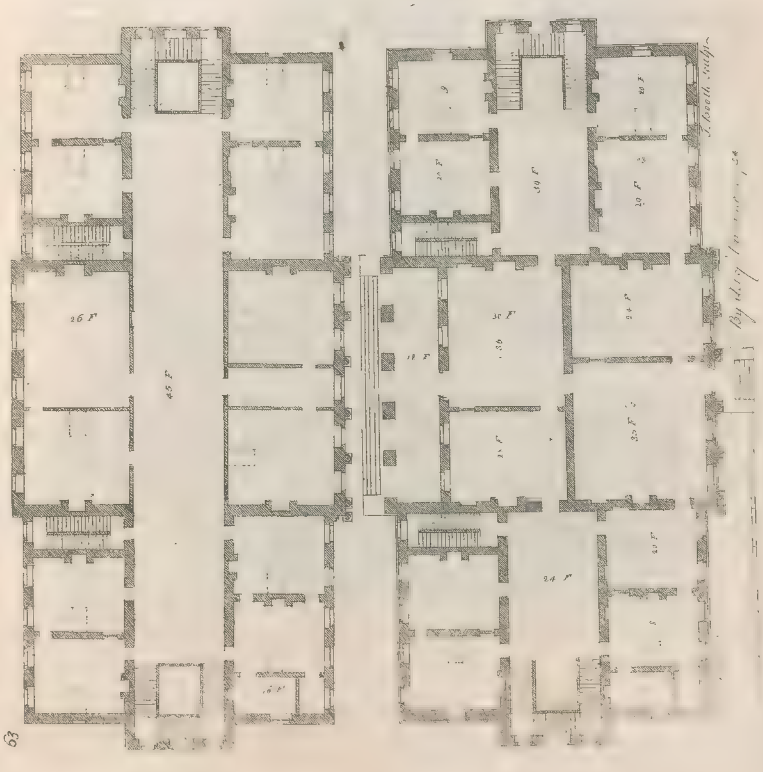

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J. Booth sculp.

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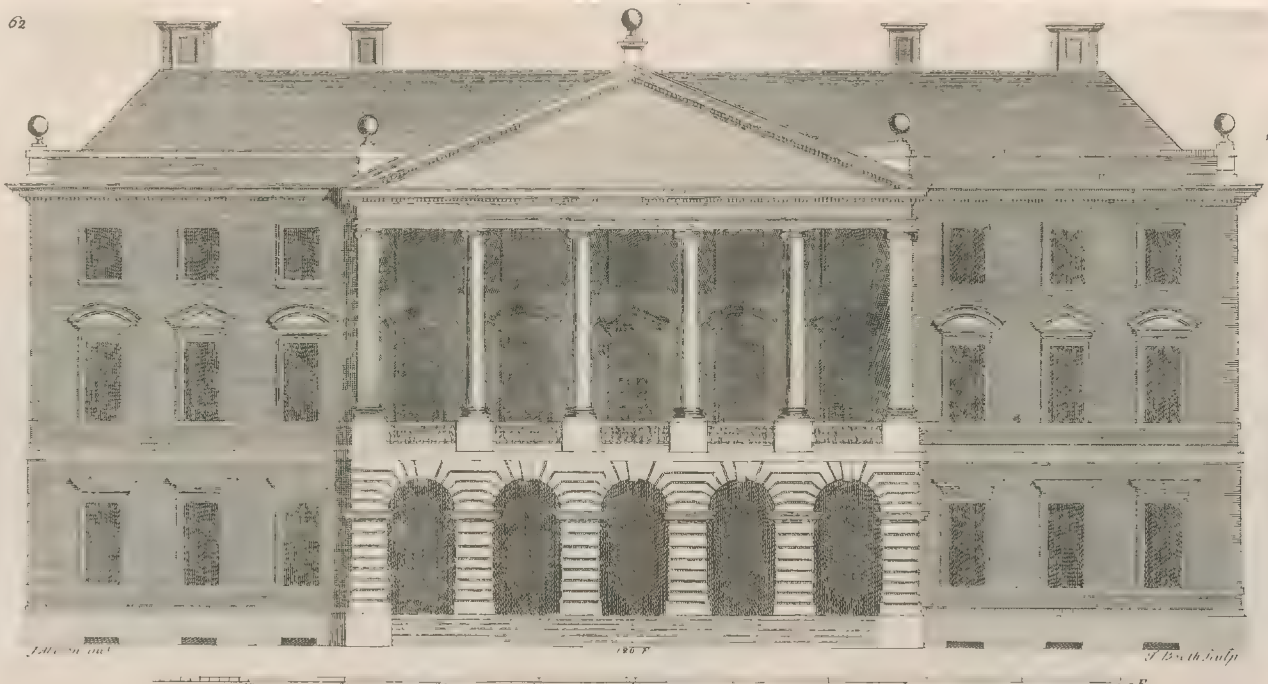

The Front of ye foregoing Plan 61

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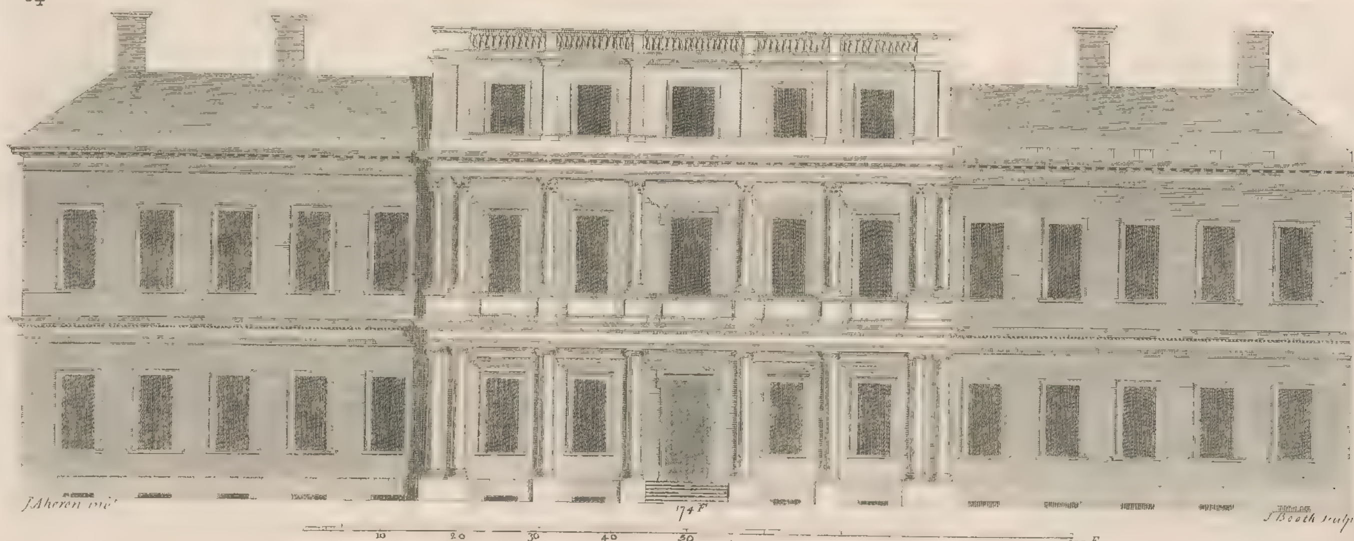

the Main Front of ye foregoing House

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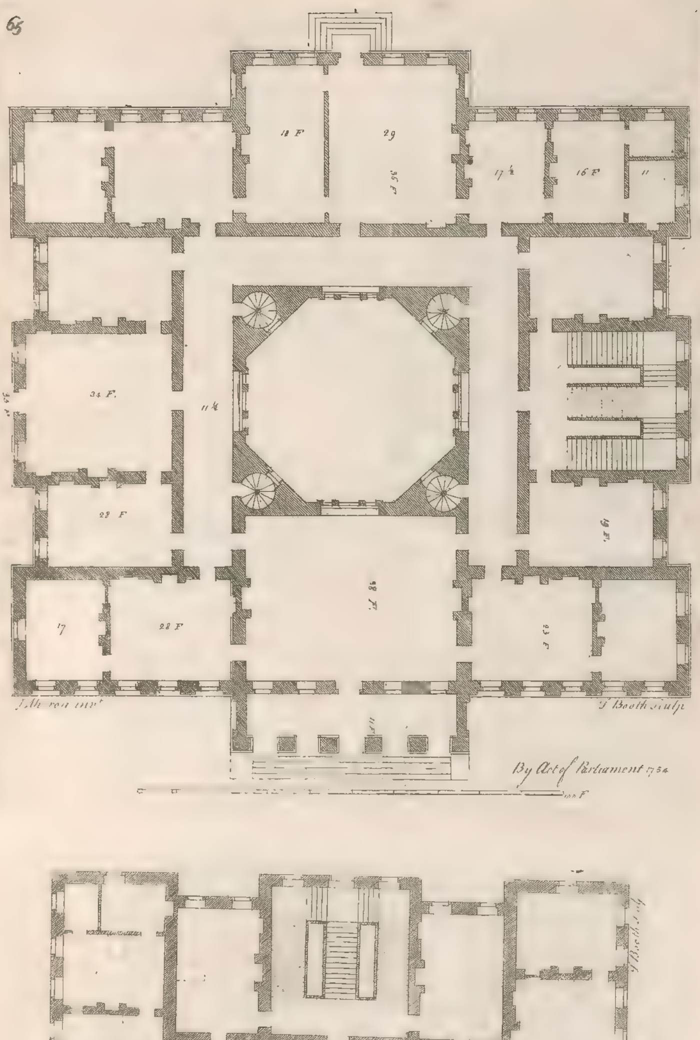
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T Booth sculp
By Act of Parliament 1754
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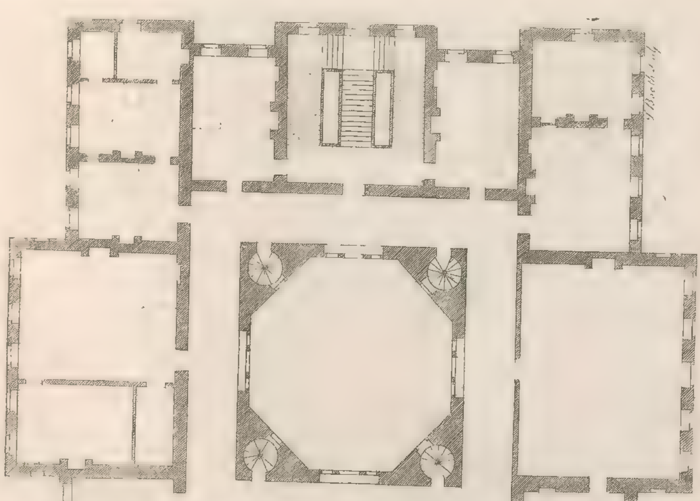

67

the Front of ye foregoing Plan

J. Aheron inv. et Sculp.

One Side of ye foregoing House

J. Aheron inv. et Sculp.


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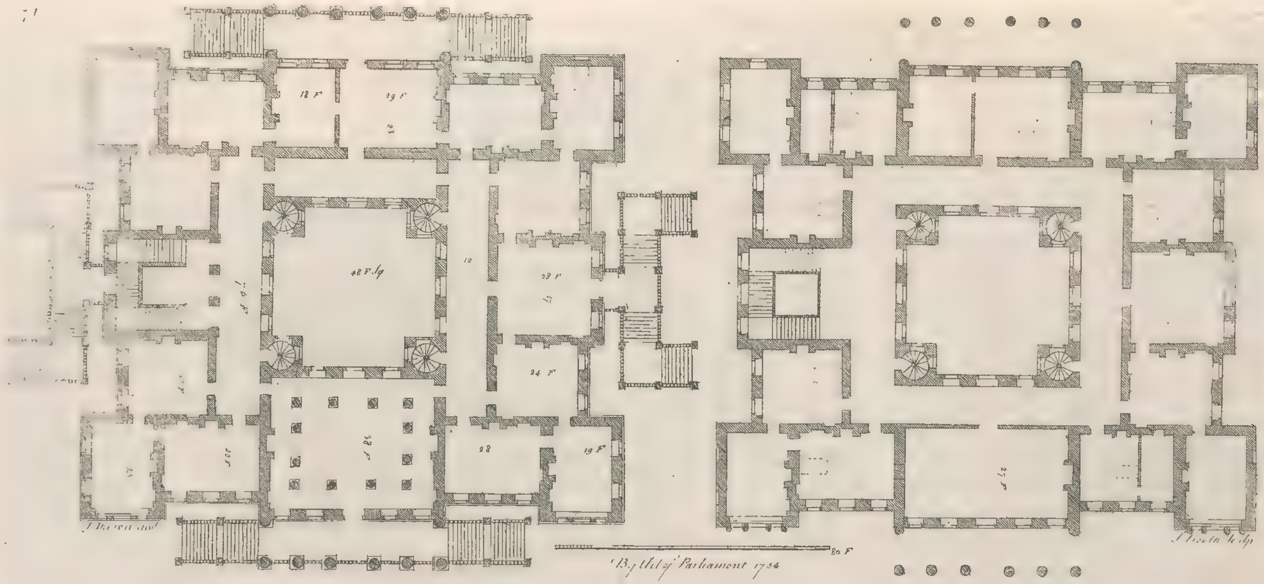
70

The Front of ye foregoing Plan


By Act of Parliament 1754

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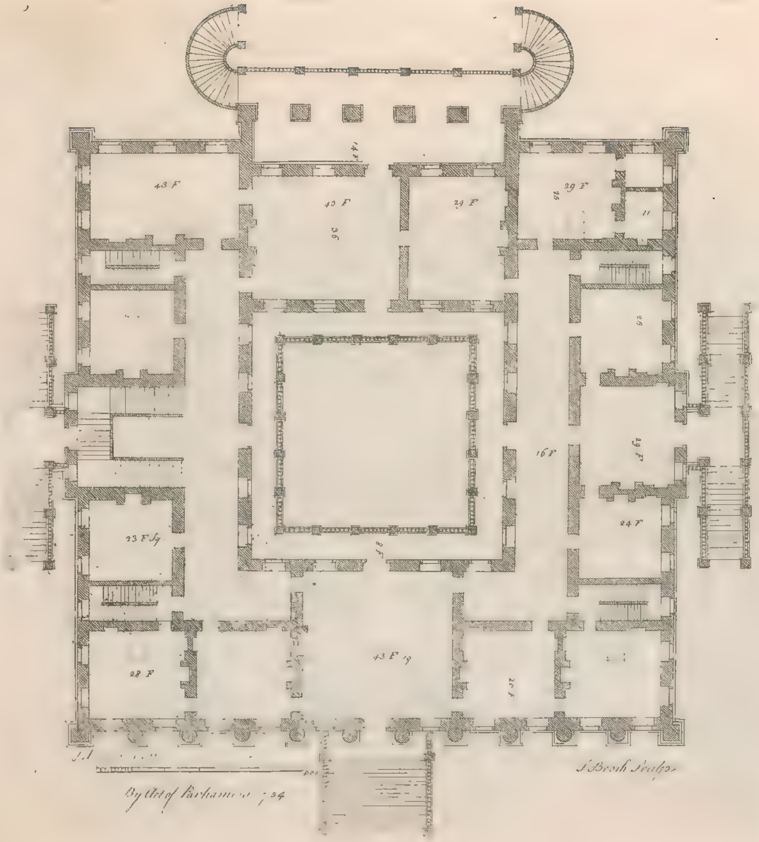
J Aheron inv

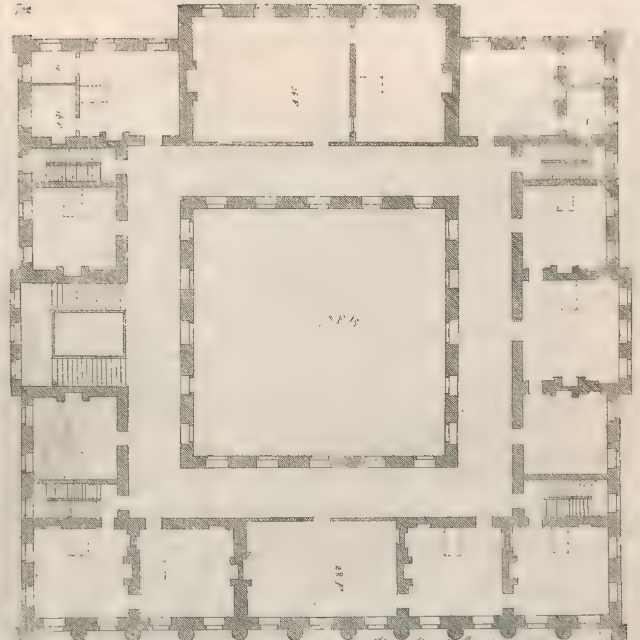
T Booth Sculp

The Front of y^e foregoing Plan



By Act of Parliament 1734

J. Booth Sculp.



The 2d Floor of ye foregoing Plan

75

the Front of ye foregoing Plan

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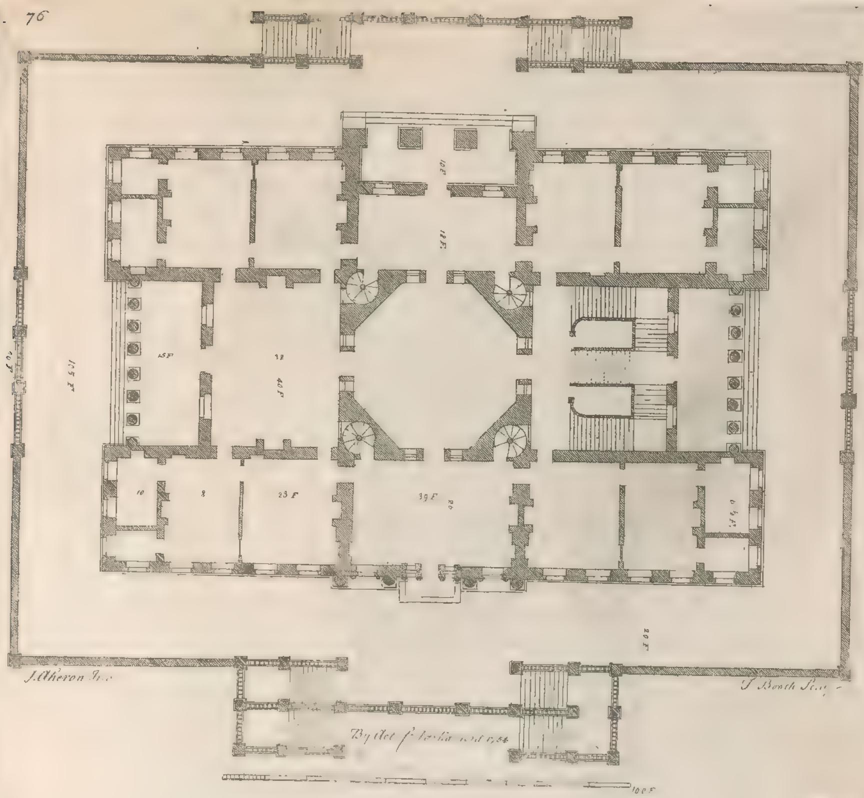

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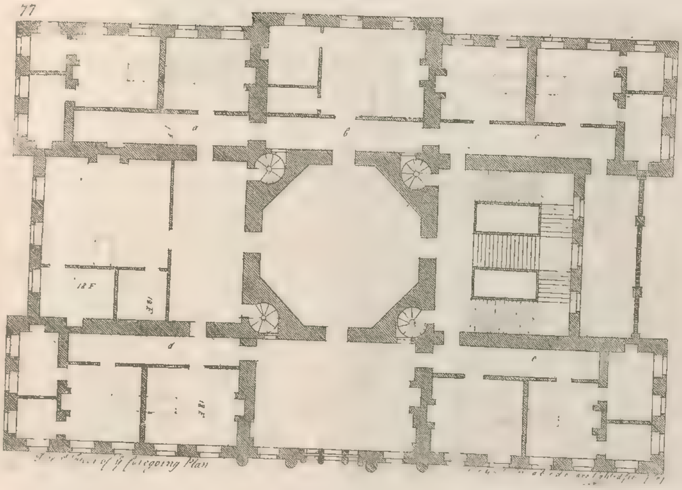

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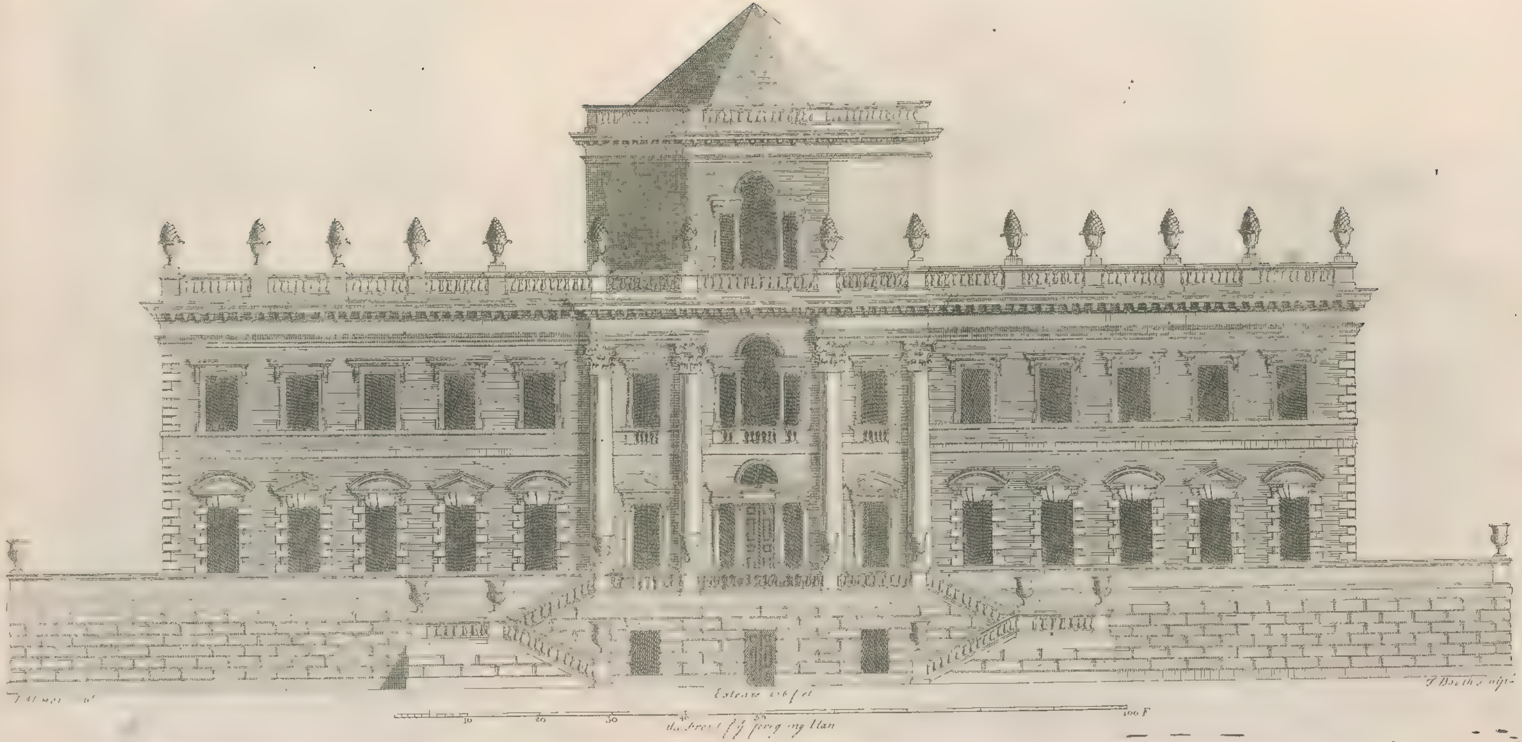
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One End of the foregoing House

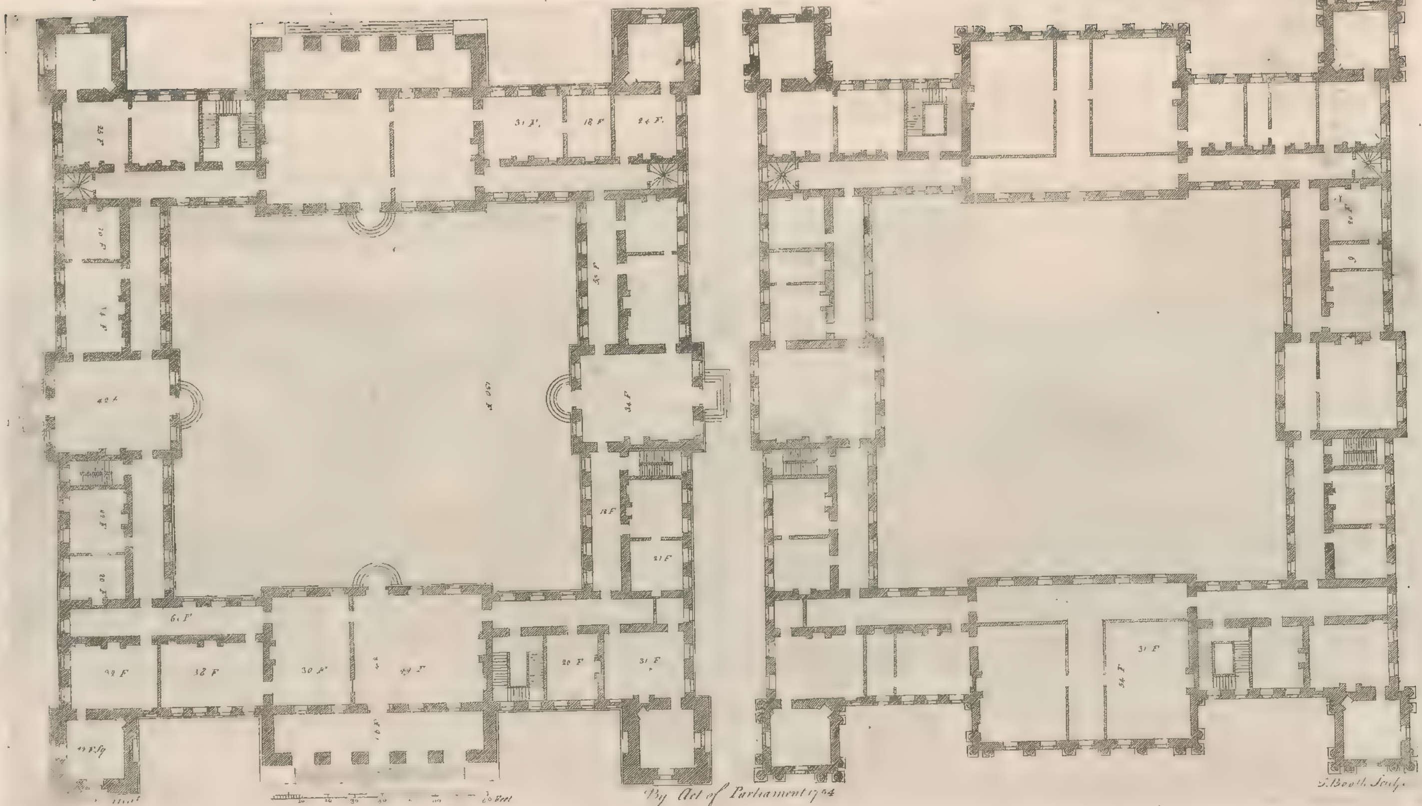
J. Booth Sculp.

80

J. Ware inv.

By Act of Parliament 17

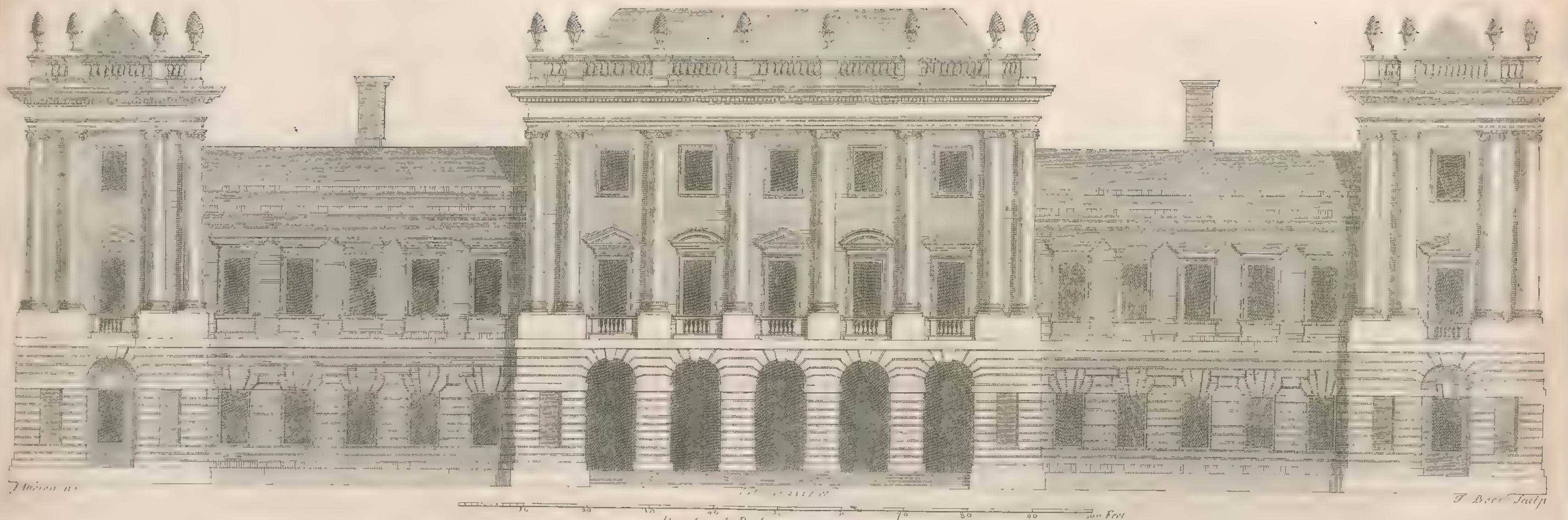
J. B. Sculp.



By Act of Parliament 1754

T. Booth Sculp.

82



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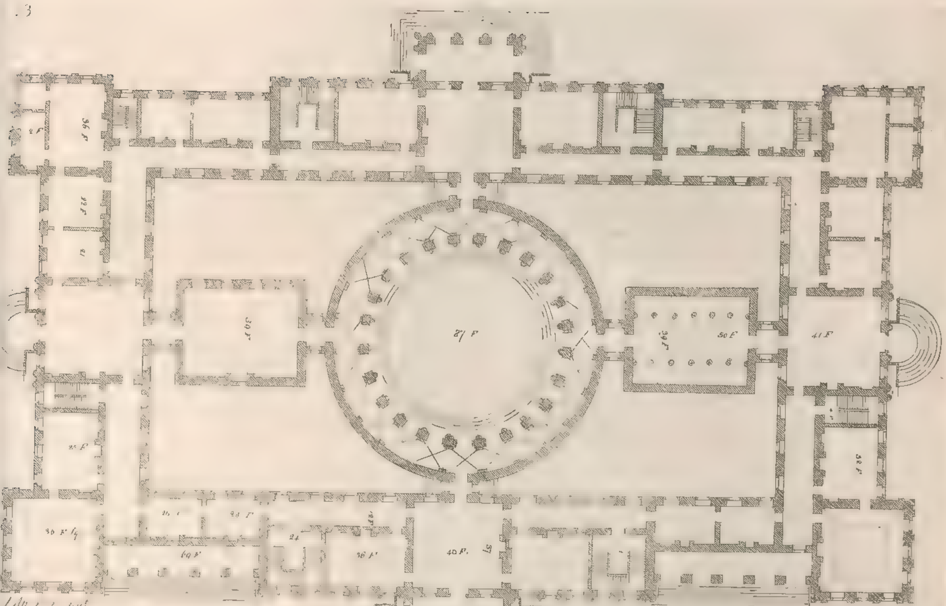
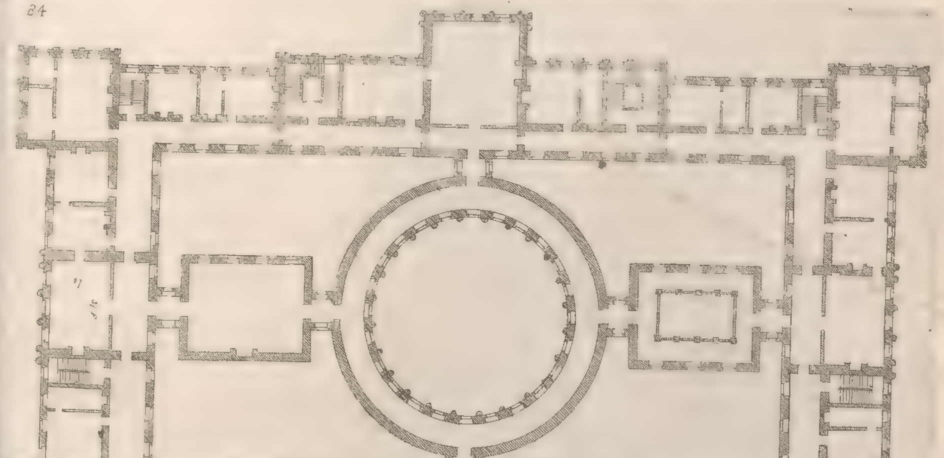


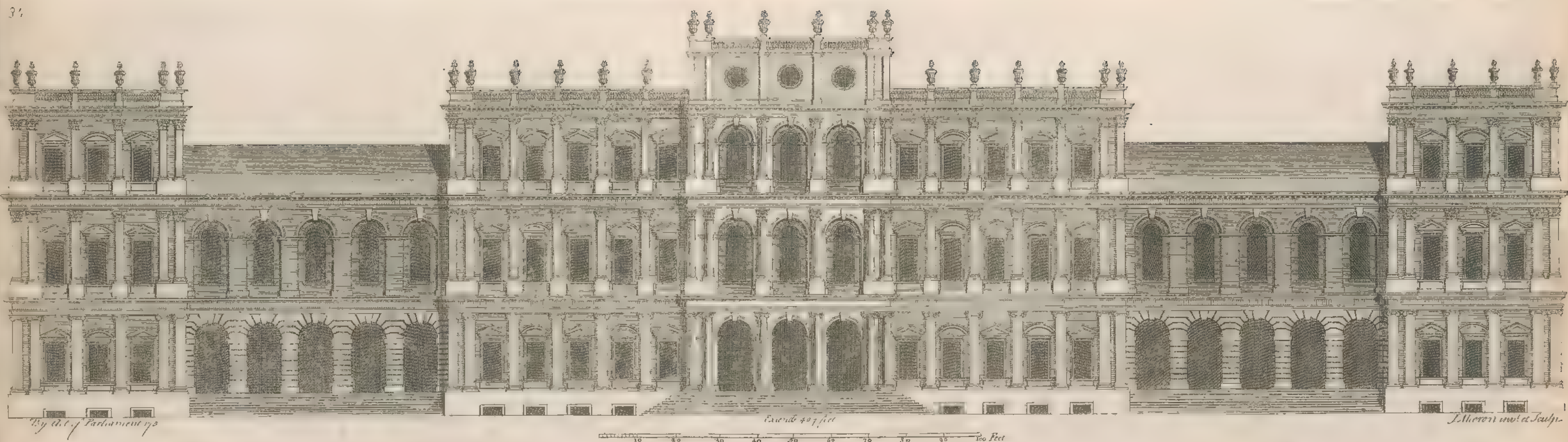
J Booth Sculp

By Act of Parliament 1754

84



the 2d Floor of ye foregoing Plan



By Act of Parliament 175

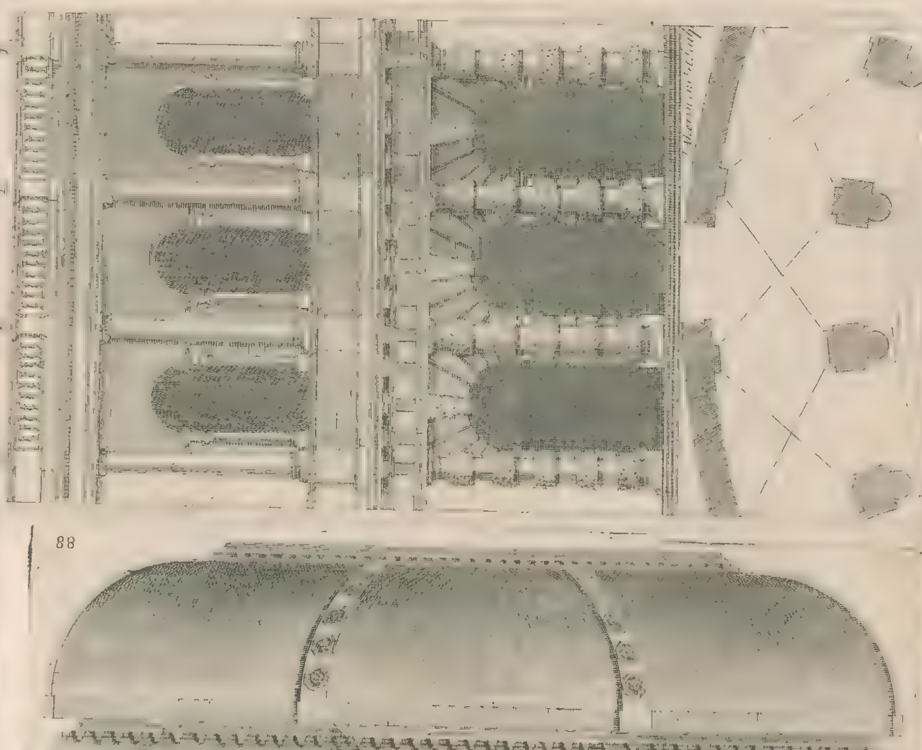
Extends 407 feet

J. Aheron inv.t et Sculp.

86

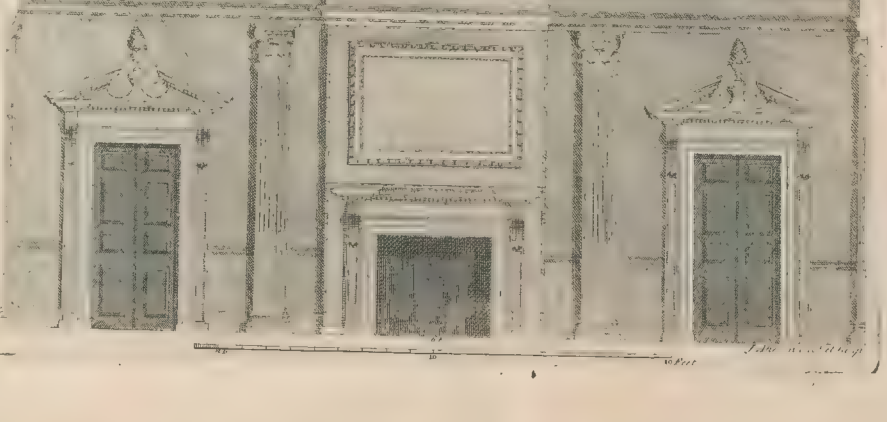
One End of ye foregoing House

J. Aheron inv. et sculp.



the Elevation of ye Circular ... in ye foregoing House

88



THE

BUILDER'S DICTIONARY,

CONTAINING

An Explanation of the TERMS made Uſe of in ARCHITECTURE. Alſo the *Terms* of *Art* uſed by Workmen concerned in BUILDING.

ABACUS is a ſquare Table, or Liſt, or Plinth in the upper Part of the Chapiters of Columns, eſpecially thoſe of the *Corinthian Order*; *Abacus* comes from the Word *Abax*.

Abrevoirs, a Term in Maſonry, by which is underſtood the Intervals, or Spaces between the Stones in laying them, commonly called the Joints.

Acanthus, the Herb whoſe Leaves are repreſented in the Chapiter, or Capital of the *Corinthian Column*.

Acroteria, are ſharp and ſpiry Battlements or Pinacles that ſtand in Ranges with Rails and Balluſters upon flat Buildings; alſo Images ſet on the Tops of Houſes, are ſo call'd by ſome.

Acroteres are Pedeſtals upon the Corners and Middle of a Pediment to ſupport Statues. They may properly be call'd Pinacles; the Word in the *Greek*, ſignifies the Extremity of any Thing, the Tip of a Finger, a Rock, or the like.

Acute Angle, an Angle that contains leſs than ninety Degrees.

Adze, an Inſtrument us'd by Carpenters to chop or cut with.

Alcove, by the *Spaniards* call'd *Alcabar*, is a Receſs within a Chamber for the ſetting of a Bed out of the Way. Alſo a Seat at the Termination of a Walk in a Garden.

Amphitheatre, is an *Edifice*, or *Building* of an Oval, or circular Form, with Rows of Seats one above another, where Spectators might ſit to behold *Stage Plays*, and other publick Diverſions.

Anabathrum, a place that is aſcended to by Steps.

Anchors, in *Architecture*, is a certain Sort of Carving, ſomewhat reſembling an Anchor, or Arrow Head; commonly Part of the Enrichments of the *Boultins* of *Capitals* of the *Tuſcan*, *Doric* and *Ionic Orders*; and alſo of the *Boultins* of Bed-mouldings of the *Doric*, *Ionic*, and *Corinthian Cornices*. Theſe Anchors and Eggs, being alternately carved throughout the whole Building.

Ancones, the Conſoles (a Sort of Brackets and ſhouldering Pieces) are call'd Ancones by *Vitruvius*. See *Conſole*.

Annulet, the ſame as Cincture, from the *Latin Annulus*, a Ring in *Architecture*, it is uſed to ſignify a narrow flat Moulding, which is common to divers Places of the *Columns*, as in the *Baſes*, and *Capitals*, &c. It is the ſame Member as the Sieur *Manclere*, from *Vitruvius*, calls a Fillet, and *Palladio* a Liſtella, or Cincture; *Brown*, from *Scammozzi*, a *Supercilium*, a *Liſt*, *Tinea*, *Eyebrow*, *Square* and *Rabit*.

Antæ, Pillars adjoining to the Wall. See *Paraſtatæ*.

Anti-chamber, from the *Italian Anti-camera*; an outer or Fore-chamber; a Room in Noblemens Houſes, where Strangers ſtay till ſuch Time as the Party to be ſpoken with is at Leiſure.

Antic, a Term in *Sculpture* and *Painting*, being a confuſed Compoſure of Figures of different Natures and Sexes, &c. as of Men, Beaſts, Birds, Flowers, Fiſhes, &c. It is alſo called *Groteſque*.

Anticum, from the *Latin*, a Porch before a Door; the Fore-door, a Hatch.

Antipagments, the Ornaments, or Garniſhing in carved Work; ſet on the *Architrave*, Puncheons, Jaumbs or Poſts of Doors, whether of Wood or Stone.

Antique, *Lat.* by Antique Buildings, we mean the Buildings of the *Greeks* and *Romans*.

Angle (in *Geometry*) is the Inclination, or Leaning of two Lines, one towards the other, the one touching the other, yet not being directly joined together, ∠ as in the Figure here here repreſented, is called an *Accute Angle*; if of this Form ⌊, it is an *Obtuſe Angle*, if of this L Form, a *Right Angle*.

Apertions, or *Apertures*, from the *Latin*, ſignifying opening; but in *Architecture*, it is uſed to ſignify Doors, Windows, Stair-caſes, Chimnies, or other Conduits; and in ſhorts all Inlets or Outlets, for Men, Light, Smoke, &c.

Aqueduct, from the *Lat. Aqueductus*, a Conveyance made for the carrying of Water from one Place to another.

Arcade, a Range of Arches with open Places to walk, as that of *Covent-Garden*, *Royal-Exchange*, &c.

Arches, it comes from the *Latin Arcus*, a Bow. In *Architecture*, it is uſed to ſignify an inward Support to the Superſtructure; and it is either circular, elliptical, or ſtrait.

Architectonic, belonging to the chief Overſeer of Buildings.

Architect, a Maſter-workman in a Building, and is he that ſupervises and gives the Draughts or Deſigns of a *Fabrick*, and Directions for a *Model* thereof, if required; and alſo he, whoſe Buſineſs it is to conſider of the Manner and Method of the the Building, and alſo the Charge and Expence of the whole.

Architecture, the Science which teacheth the Art of Deſigning, and raiſing all Sorts of Structures, according to *Geometry* and *Proportion*: Containing under it all thoſe *Arts* that conduce in any Thing to the framing of Houſes, Temples, &c. The Scheme or Projection of a Building is eaſily drawn or laid down in three ſeveral *Draughts* or *Deſigns*. The Firſt

is a Plan, which shews the Extent, Division and Distribution of the Ground into Apartments and other Conveniences. The Second, shews the Stories, their Heights, and outward Appearances of the whole Building; and this we call the Design, or Elevation. The Third, call'd the Section, is the Inside; and from these three Designs, the Undertaker forms a Computation of the Expence of the whole Building, and the Time requir'd to go through with it. So much for what is called Civil *Architecture*. Military *Arichitecture*, usually called *Fortification*, has for its Object, the making of a Place of difficult and dangerous Approach to an Enemy.

Archives, a Place where ancient Records, and Evidences of a Nation are kept, also Records themselves.

Architrave, the Word comes from the *Greek Archos*, Chief, and the *La. Trabs* a Beam. It is also sometime called *Epistle*, from the *Greek Epi* upon, and *Stulos*, a Column. It is used in *Architecture*, to signify the Moulding or Ornament, next above the *Capital* of a *Column*, it being always the next Member below a *Frize*: The Word is also sometimes used to signify the chief or principal Beam of a Building, as what we call *Porticos*, *Piazzas* or *Cloysters*. By *Cloysters* we understand a long Kind of Galleries, or Walking-places, whose Roof is born or supported by *Columns* or *Pilasters*, at least on one Side, and have not Arches rising from them to bear the superincumbent Part of the *Fabrick*, but have a Beam resting, or lying upon the Tops of the *Columns*, by which the superior Part of the *Edifice* is supported; upon which Account, I suppose it to be called a chief or principal Beam. In Chimnies, the *Architrave* is the Mantil; over the Jaumbs of Doors, it is called *Hyperthyron*.

There are also *Architrave* Doors and Windows; those are called *Architrave* Doors, which have an *Architrave* on the Jaumbs, or Puncheons, and over the Doors upon the Cap-piece, if strait. Also upon the Jaumbs and Cap-pieces of Windows. The Form of these *Architraves* about Doors are not always the same; for sometimes they are according to one of the five *Orders* of *Architecture*, and sometimes according to the Workman's Fancy.

Aræostyle, by this Word *Vitruvius* used to signify the greatest Interval, or Distance, which can be made between *Columns*, consisting of four Diameters. It comes from the *Greek Araios*, thin Set, or *Rara*, and *Stulos*, a *Column*.

Ashlar; By *Ashlar* is meant common or free Stones, as they come out of the Quarry, of different Lengths and Thicknesses.

Ashlering, quartering in Garrets about $2\frac{1}{2}$, or 3 Foot high, perpendicular to the Floor, up to the under Side of the Rafters.

Astragal, a little round Moulding, which encompasses the Top of the Fust, or Shaft of a *Column*. It comes from the *Greek Astragalos*, the Bone of the Heel. The Shaft always terminates at Top with an *Astragal*, and at Bottom with a *Fillet*, which in this Place is called *Ozia*.

Attic, in Building, a little *Order*, placed upon another much greater; for instead of *Pillars*, this *Order* has nothing but *Pilasters*, with a *Cornice* architraved for an *Entablature*, as that, for Instance, in the Castle of *Versailles*, above the *Ionic*, on the Side of the Garden.

Attic, or *Athenian* Base, has a *Plinth*, 2 *Torus's*, and 2 *Fillets*.

B A

BACK, *Baguette*, a Kind of Astragal, or Hipmoulding, is a Term in Carpentry, by which they signify the outward Angle, or the Hips or Corners of a Roof, which in square Frames where the Roof is $\frac{3}{4}$ Pitch, contains an Angle of 116 Degrees 12 Minutes. It is also a Term used by Iron-mongers, to signify a certain Sort of Nails.

Balcony, is a Kind of an open Gallery (without the Walls of a House or Building) for People to stand in, and behold any Action, as Pageants, and the like in Cities, or to take the Air, &c.

Baldaquin, is a *French* Word, which properly signifies a Canopy carried over the Holy Sacrament, among the *Roman Catholicks*; it is used by *Architects*, to signify a Piece of *Architecture*, built in Fashion of a Canopy, or Crown supported by several *Pillars*, to serve for a Covering to an *Altar*; some also use it to signify a Shell over the Front Door of a House.

Balks, Pieces of Fir-timber coming from beyond Seas.

Ballon, *French*, a Term in *Architecture*, signifying the round Globe at the Top of a Peer or Pillar.

Ballustrade, a Term in *Architecture*, used to signify a Row of turned *Pillars*, called *Ballusters*, made of Marble, Iron, Wood or Stone, so high as for a Man to rest his Elbows on, fixt upon a Terrasse, or upon the Top of a Building, or to make any Separation.

Band, in *Architecture*, is any flat Member, that is broad, and not very deep; the Word Face is sometimes used, to signify the same Thing.

Bandelets, it is derived from the *French Bandelette*, a little *Fillet*, or *Band*, it is used by *Architects*, to signify the three Parts that compose an *Architrave*.

Bargecourse, is a Term used by Workmen, by which they signify a Part of the Tyling, which projects over, without the principal Rafters in all Buildings where there is a Gable End.

Base, from the *Greek Basis*, a Rest or Support to any Body, and which bears up another; but is particularly applied to the Bottoms of *Columns* and *Pedestals*.

Basilic, this, among the *Ancients*, was a large Hall with *Portico's*, *Isles*, *Tribunes*, and *Tribunals*, when the Kings themselves administer Justice. *Basiliscos*, in *Greek*, signifies Royal.

Batter, a Term used by Workmen to signify, that a Wall, a Piece of Timber, or the like, doth not stand upright, but leans from yonward, when you stand before it; but when it leans towards you, they say, it over-hangs, or hangs over.

Bay, the Word is used to signify (as it were) the Magnitude of a Barn; for if a Barn consists of a Floor and two Beams, where they lay the Corn, they say a Barn of three Bays.

Bay-Window, is such a one as is composed of an Arch of a Circle; and so by Consequence will stand without the Stress of the Building.

Bead, a Moulding so called, which is commonly made upon the Edge of a Piece of Timber, and known by all Workmen.

Beam, in Building is a Piece of Timber, which always lies cross the Building, into which the Feet of the principal Rafters are framed.

Beam-filling, is Bricklayers Work, it is only filling up the Vacancy betwixt the raising Plates and the Joists.

Bedding-Moulding, is a Term commonly used by Workmen, it consists of those 4 Members, 1 (below) an Ogee, 2. a List, 3. a large Boultin; and *lastly*, under the Coronet, another List; that is what they frequently call, a Bed-moulding.

Bevil, any Thing that is not square, may be called *Bevil Angle*, whether it be more Obtuse, or more Acute than a Right Angle.

Binding Joists, are those *Joists* in any Floor, into which the Trimmers of Stair-cases (or Well-holes for the Stairs) and Chimney ways are framed; these *Joists* ought to be larger than common *Joists*.

Boast, among Workmen, is the taking off the superfluous Part in carving, or Mouldings, &c.

Borders, among Workmen, are those Pieces which go

go round the Slabs of Chimnies in the Floor; also all plain Spaces round Carving, Painting, &c. is called *Border*.

Bond, a Term used among Workmen; for when they say, make good *Bond*, they mean, fasten the two or more pieces of Timber well together, either with tenanting and mortising, or Dove-tailing, &c.

Botham, is an Iron-mongers Term, by which they Use to signify a certain Sort of Nails.

Boulder-Walls, that is *Walls* made of round Flints, or Pebbles, which are found where the Sea hath a Breach cast up; and also at some other Places, where there is plenty of Flints.

Boultin, in *Architecture*, is a convex Moulding, that consists of ¼ of a Circle, being the Member next below the *Plinth* in the *Tuscan* and *Doric Capitals*.

Brace, in a Building, is a Piece of Timber, which is framed in with bevil Joints, its Use is to keep the Building from swerving, either this or that Way, they are sometimes called Struts, *viz.* when they are framed in the King-piece, and principal Rafters.

Bracketts, or *Bragottes*, are the seeming Supports of the Ends of Steps to Stairs, also to Shelves.

Breft, a Term in *Architecture*, made Use of by some to signify the same Member in a Column, that others call a *Thorus*.

Breft Summers, in a Building, are Timbers into which the Girders are framed in the first Floor; but when in the Ground Floor, then it is called a Beam.

Buttement, is a Term used by Masons, and Bricklayers, by which they mean the Supporters or Stays on, or against which, the Feet of Arches rest.

Button-Nails, are a Sort of Nails with round Heads, and but short Shanks, tinned and lackered.

Buttress, a Term in *Architecture*, used to signify a Strength or Support, either of Brick or Stone, intended to keep the Work the firmer in its Position, as against Brick or Stone Walls that are high, or have any considerable Weight against them on the other Side, such as a Bank of Earth, or the like. They are also used against the Angles of Steeples, Churches, and other Buildings of Stone.

C A

CABINETS, strictly taken, is the most retired Place in a House; but a *Cabinet* in Palaces and great Houses, consists of an Out-chamber, and a *Cabinet* with a Gallery on the Side.

Caliducts, that is, Conveyors of Heat. The *Ancients* used to warm their Rooms with certain secret Pipes (called *Caliducts*) that were conveyed in the Walls, transporting Heat to sundry Parts of the House, from one common Furnice.

Camber-Beams, Pieces of Timber cut arching (or with an Abtuse Angle) in the Middle. *Camber-Beams* are commonly used in Plat-forms, as Church-Leads, &c.

Cames, the slender or small Rods of Cast-leads, of which the Glasiers make their turned Lead.

Camerated, vaulted, or arched.

Cantalivers, the same as *Modillions*, only these are plain, but those are carved. They are both a Kind of Cartouzes, set (at equal Distances) under the Corona of the Cornice of a Building.

Cantaliver Cornice, is such a *Cornice* as has *Cantalivers* under it.

Capital, is the upper Part of a *Column*; such as have no Ornaments, are the *Tuscan* or *Doric*, we call Capitals with Mouldings; the Rest which have Leaves, and other Ornaments, Capitals with Sculptures. The Word is derived from the *Latin Caput*, the Head or Top of any Thing.

Carcase, the Timber-work (as it were the Skeleton) of a House, before it is lathed and plaistered.

Cariatides, from the *Greek Kariatydes*, a People of *Caria*, by these in *Architecture*, are meant certain Figures of captive Women, dressed after the Manner of that Nation, and serving instead of *Columns* to support the *Entablements*.

Car-Tooses-Touzes, in *Architecture*, are much the same as *Modillions*; only these are set under the *Cornice* in wainscotting, and those at the Eves of Houses.

Cartouche, *Perrault* says, it is an Ornament of carved Work of no determinate Form, whose Use is to receive a Motto, or Inscription, the Word being borrowed from the *Italian Cartoccio*.

Cartridges, in *Architecture*, are the same as *Cartoozes*.

Case of Glass, a Case of Crown Glass contains 24 Tables, each Table being circular, or nearly so, and about 3 ½ Feet, or 3 ¾ Feet Diameter.

Casement, in Architecture, is a hollow Moulding; also an Iron Frame to Windows is so called.

Cast, among Workmen, a Piece of Timber, or a Board, or the like, is said to cast, or to be cast, when by the Drought or Moisture of the Air, or by its own Drought, or Moisture, or other Accident, it alters its Flatness or Straitness, and becomes crooked.

Caladrome, a Kind of Engine, like a Crane, which Builders use in lifting up, and letting down any great Weight.

Cathetha, a Perpendicular, or Plumb-line, falling from the Extremity of the under Side of the Cimatium (of the *Ionic Capital*) thro' the Centre of the *Voluta*.

Cavetto, a round Concave Moulding, which has a quite contrary Effect, to the Quarter-round; the Workmen call it *Mouth*, when in its natural Situation, and *Throat* when turned upside down.

Cavation, a Term of *Architecture*, signifying the under Digging, or hollowing of the Earth for the Foundation of the Building. *Palladio* says, it ought to be ⅙ of the Height of the whole Building.

Caulicoli, the carved Scrolls under the *Abacus*, in the *Corinthian Capital*.

Ceiling, in *Architecture*, is the Lathing and Plaistering at the Top of a Room upon the under Side of the Joists of the next Room.

Cement, in *Architecture*, is a strong, sticking, cleaving or binding Mortar; of which there are two Sorts, *viz.* cold or hot Cement.

Chambers, in a House or Building, are the Rooms between the Ground-story and Garrets; so that there are some Buildings two or more Stories of Chambers.

Channel, in the *Ionic Capital*, is that Part which is under the *Abacus*, and lies open under the *Echinus*, or *Eggs*, which has its Centers on every Side, to make the Volutas; also the ornamental Parts of the *Doric* Triglyphs; and the Paving in the Middle of a Street, are so called.

Chapiter, in *Architecture*, signifies the Top, or Head of a Pillar.

Chimney Jaumbs, the Sides of a Chimney, commonly coming out perpendicularly, (tho' sometimes circularly) from the Back, on the Extremities of which, the Mantle-tree resteth.

Chimney-pieces, certain Mouldings of Wood or Stone standing on the Foreside of the Jaumbs, and coming over the Mantle-tree.

Chord, is a Line in a Circle connecting the two Ends of any Arch.

Chima-recta, or *Cimaise*: from the *Greek Kymation*, a Wave, call'd by the *English* Workmen *Ogee*; which is of two Kinds, *viz. Cima-recta*, and *Cima-reversa*, or the back *Ogee*, whose Beauty consists in having its Height and Projecture equal to each other.

Cincture, is a List, or Fillet at the Top or Bottom of a *Column*; that at the Top is sometimes called *Colier*, and sometimes *Annulus*.

Cilery, a Term in *Architecture*, signifying the Drapery, or

or Leafage that is wrought upon the Heads of Pillars.

Ciſterns, are Veſſels made to ſerve as Receptacles for Rain, or other Water; for the neceſſary Uſes of Families.

Circle, is a plain Figure comprehended under one only Line, called its *Circumference*, whence all the Lines drawn to its Centre, are equal to one another.

Circumferentor, the Name of an Inſtrument for ſurveying of Land.

Clamp, a Clamp is a Kiln, built above Ground, for the burning of Brick; alſo Pieces on the Ends of Shutters, Tables, &c. are ſo called.

Clinkers, thoſe Bricks are ſo called by ſome, which by the Violence of the Fire run, and are glazed over,

Cloiſter, a cloſe and ſeparate Habitation, where *Friers*, *Nuns*, and *Monks* live retired from the World; alſo a long Place, covered with a Floor, or Plat-form, ſupported by *Pillars*.

Coins, See *Quoins*.

Collar-Beam, a Beam framed croſs betwixt two principal Rafters.

Coloſſus, this is applied to any Figure that is far greater than Life; alſo a Building is called a *Coloſſus*, when of extroardinary Bigneſs, as the ancient *Amphitheatres*, the *Pyramids* of *Egypt*, &c.

Column, *Perrault* ſays, it is an Ornament of carved Work, of no determinate Form, whoſe Uſe is to receive a *Motto*, or *Inſcription*; the Word being borrowed from the *Italian*, *Cartoccio*.

Compartition, by this Term *Architects* underſtand a graceful Diſtribution of the whole Ground-plot of a Building into Rooms of Office, and of Reception or Entertainment.

Compartment, in *Architecture* is a particular Square for an Inſcription or ſome other Device, marked out in ſome ornamental Part of a Building.

Concamerate, to make an arched Roof, as in Vaults, &c.

Concave, hollow, and Concavity is the Hollowneſs of of any Thing.

Concentrick, Figures that have the ſame Centre.

Conclave, in *Architecture*, is a Cloſet, or Inner-Chamber.

Conduits, Sewers, or Gutters, to convey away the Sullage of a Houſe.

Cone, a *Latin* Word, a Geometrical Figure of a Pyramidical Form like a Sugar Loaf.

Conges, in *Architecture*, are the Rings, or Ferrils, heretofore uſed in the Extremities of wooden Pillars, to keep them from ſplitting; afterwards imitated in Stone-work.

Conſole, to cloſe up in any Ornament cut upon the Key of an Arch, which has a Projecture, or Jutting, and, on Occaſion, ſerve to ſupport little Cornices Figures, Buſts, and Vaſes, &c.

Contour, the Out-line of any Member in *Architecture*, as that of a *Baſe*, or *Cornice*, &c. a *French* Word.

Contignation, a Story in Building, in *Latin*, *Contignatio*, ſignifies the laying of Rafters together.

Contramure, in *Architecture*, is an Out-wall, built about the Wall of a City.

Copeing of Walls, is the Top or Cover of it, made ſloping to carry off the Water.

Corbeilles, *French*, ſignifying a *Basket*, is a Piece of carved Work, in the Form of a Baſket full of Flowers, Fruits, ſerving in *Architecture*, to finiſh ſome Ornament.

Corbel-bet-bil, a Shouldering piece in Timber-work, jutting out like a Bracket.

Corbel, Holes left in the Walls of antient Churches, &c for Images to ſtand in.

Cornice, comes from the *French Corniche*, and makes the third or uppermoſt Member of the *Entablament*, which is different in the ſeveral *Orders*. The Word *Cornice*, however is applied to every prominent, or jutting Member that crowns any Body; and thus we ſay, the *Cornice* of a *Pedeſtal*, &c. *Cornices* are alſo plac'd on the Top of a Wainſcot, and under Eves of Houſes, &c.

Corona, *Cornice*, or *Crowning*, theſe Words are indifferently applied to any Thing that finiſhes an Ornament in *Architecture*; as for Inſtance, to a *Cornice* or *Pediment*, &c. *Block Cornices*, are ſuch as have a Kind of plain *Modillions*, without any Caps, under the *Corona*.

Coving Cornice, has a great Caſement, or Hollow in it, which is commonly lathed and plaiſtered upon Compaſs, Sprockets, or Brackets.

Coveings, or *Cornice Stones*, are thoſe Stones on the Sides or Jaumbs of a Chimney. They are generally of Rigate, or Free-ſtone, and their Faces are hollowed in Breadth; in grand Buildings they are of Marble.

Couſinet, the firſt Stone, whence a Vault or Arch commences.

The little *Cornice*, or *Plinth* that crowns the Pier, and ſupports the *Couſinets*, is called *Impoſts*.

Crown, as *Corona*.

Crown Poſt, is that *Poſt* which (in ſome Buildings) ſtands upright in the Middle, between two principal Rafters, from which there goes Struts, or Braces, to the Middle of each Rafter; it is called a *King-piece* or *Joggle-piece*.

Cubicle, a Bed-chamber.

Culinary, of, or belonging to the Kitchen.

Culvertail, as Dovetail.

Cupola, in *Architecture*, is a ſmall Room, either circular, or polygonal, ſtanding on the very Top of a Building; ſome call it a Lanthorn.

Cymace, *Cymatium*, as Ogee.

D A

DADO, or *Dye*, the plain Part of the Pedeſtal.

Decor, or more properly *Decorum*, this Word is perfect *Latin*, and ſignifies the keeping of a due Reſpect between the Inhabitant and Habitation.

Denticles, or *Dentils*, Ornaments in a *Cornice* cut after the Manner of Teeth (from *Dens* a Tooth) Theſe are particularly affected in the *Corinthian Order*, and the Square Member, wherein they are cut, is called the *Dentils*; in *Latin*, *Denticulus*.

Dyaſtile, an *Edifice*, where the *Columns* are placed at the Diſtance of three Diameters, or Modules from one another.

Dye, this Term is applied to any ſquare Body, as the Trunk or naked Part of a *Pedeſtal*, which is that Part included between the *Baſe* and the *Cornice* thereof.

Diptere, among the Ancients, a Kind of Temple, or other Edifice, incompaſſed with a double Row of *Columns*; it ſignifies in *Greek* two winged. The Pſeudo (or falſe) *Diptere* was the ſame; excepting, that inſtead of the double Row of *Columns*, this was only encompaſſed with a ſingle One.

Dome, alſo a *Cupola*, a round Piece of *Architecture*, (reſembling the Bell of a great Clock) ſet upon the Top of a Building, particularly upon Cathedral Churches, where it ſometimes ſerves for the Bell Tower, the *Dome* of St. *Paul*'s is well known.

Dormant-tree, in *Architecture*, is a great Beam lying croſs a Houſe, otherwiſe called a Summer.

Dormer, in *Architecture*, is a Window in the Roof of a Houſe, it ſtanding upon the Rafters.

Doucine, See *Sima*. It is an upright Ogee.

Dove-Tails, a Sort of Joints, or Hinges, ſo called, they reſembling the Tail of a Dove or Pigeon.

Dove-Tailing, among Workmen, is a Manner of Faſtning Boards, (or any Timber) together, by letting one Piece into another in the Form of a *Dove's* Tail.

Drag, with Workmen, a Door is ſaid to drag, when in

in opening and shutting it stops upon the Ground, or Floor.

Dragon-Beams, Dragon Beams are two strong Braces or Struts, that stand under the Brest-summer meeting in an Angle upon the Shoulder of the King-piece.

Drapery, a Term in *Architecture*, and *Painting*, it being a Work, wherein Cloaths are represented: As also *Cilierie*.

Drip; this is call'd Larmier in *French*, and is the Bottom of the *Corona*; because the Rain-water is by Means thereof forced to fall Drop by Drop on the Ground, dripping like Tears.

Draught, or *Design*, is the Picture of an intended Building described on Paper, wherein is laid down (by Scale and Compass) the devised Divisions and Partitions of every Room, in its due Proportion to the whole Building.

Drips, in *Architecture*, are a certain Kind of Steps (made on a flat Roof) to walk upon, a way of Building much used in *Italy*; the Roof is not quite flat, but a little raised in the Middle; and these Steps or Drips lie each a little inclining to the Horizon.

Drops, in *Architecture*, are an Ornament of the *Doric Order*, underneath the *Triglyphs*, representing Drops, or little Bells.

E A

EAVES, is the Margin of the Roof of a House, *viz.* that Part of the Roof, which hangs over without the Walls.

Echinus, is sometimes used to signify the Quarter-round; but more commonly that Part of it, which includes the *Ovum*, or *Egg*. It comes from the *Greek Euchinus*; the Shell of a Chestnut.

Eggs. See Anchors and Quarter-rounds.

Elaboratory, a Place to work in, properly a Chymist's Work-house, or Shop.

Embossing, in *Architecture*, is a Kind of Sculpture, or Engraving, wherein the Figures stick out from the Plane whereon they are engraven, and according as they are more or less protuberant is call'd by the *Italians*, *Basso*, *Mezzo*, *or Altorelievo*, used by the *English Bass-relief*, *Mean-relief*, or *High-relief*.

Embrasure, in *Architecture*, is the Enlargement that is made in a Wall on the Inside of a Window, or Gate, to give the more Light, for the more Convenience of the Gate or Window.

Entablement, or *Entablature*, by *Vitruvius* and *Vignole*, is called Ornament, and signifies the *Architrave*, *Frize*, and the *Cornice* together; it is likewise call'd *Trabeation*, and is different in the different *Orders*. The Word seems to be borrowed from the *Latin Tabulatim*, a Ceiling; because we suppose the *Frize* to be formed by the Ends of the Joists which bear upon the *Architrave*.

Enterfole, sometimes call'd *Mezzanine*, is a Kind of low Story at the Top of a Building for lodging Servants, &c.

Entry, in *Architecture*, is a Room designed only, or chiefly, for a Passage thro' and fro' betwixt other Rooms, or from the outer Door into the House.

Epistyle-Tylium. As Frize

Eurithimia, a Term in *Architecture*, used by *Vitruvius*, by which he intends only that agreeable Harmony, that ought to be between the Length, Breadth, and Height of each Room in a Fabrick.

Eustyle, is the best Manner of placing *Columns*, with Regard to their Distance, which *Vitruvius* made to be 2 ¼ Diameters. The Word is compounded of *Eu*, good, and *Stulos* a *Column*.

Eyebrow, as List or Fillet. See *Capital*

Eye, in *Architecture*, is the Middle of an *Ionic* Volute, or Scroll, cut in the Form of a Rose;

F A

FABRICK, a Church, a House, or any other Building.

Face, in *Architecture*, is any Member that has a great Breadth, and but small Projecture, as the *Architrave* in the Front of a Building.

Face of a Stone, by which Workmen mean that Superficies or Plain of the Stone, that is to lie in the Front.

Facia, or *Fascia*, Mr. *Perrault* says, it signifies any flat Member; as the Bands of an *Architrave*, &c. there are some who write it *Fasce*, grounded upon a *Latin* Word *Facia*, a large Riband, which *Vitruvius* makes use of on the like Occasion.

Feather-edged, Boards, or Planks that are thicker on one Edge than the other.

Felling, of Timber, the proper Season usually commences about the End of *April*, because then the Bark rises most freely, and if there be a Quantity to be felled, the *Statute* obliges to fell it then, the Bark being so useful for the *Tanners*.

Fence Walls, Walls of Brick or Stone made round Yards, &c.

Festoon, an Ornament of carved Work in the Manner of a Wreath, or Garland of Flowers, or Leaves twisted together, thickest at the Middle, and suspended by the two Extremes, whence it hangs down with a graceful Sweep.

Fillet, is any little square Moulding, which accompanies a Larger.

Fire-Stone, *Rigate Stone*, called Fire-Stone, is a Sort of Stone very good, and much used for Chimney Fire-hearths, Ovens, Stoves, &c.

Flemish Bricks, are a Sort of Bricks brought out of *Flanders*, and used for paving; being much neater, and stronger than common, or Clay-bricks, they are of a yellowish Colour, and each Brick is 6 ¼ Inches long, 2 ½ Inches broad, and 1 ½ Inch thick.

Floating, a Term used by Plaisterers for their best Cielings.

Floor, a Floor in *Architecture*, is the bottom Part of a Room, on which we walk. Floors are of several Sorts; some are of Earth, some are of Bricks, some of Stone, and some of Wood. Carpenters by the Word Floor, understand as well the fram'd Work of Timber, as the boarding over it.

Flush, a Term used by Carpenters when the Work is even or smooth; also in Masonry, it signifies the breaking off of any Part of the Stone.

Flutes, or *Fluteings*, in *Architecture*, are the Hollows made in the Body of a *Column*; the *Doric*, *Ionic*, *Roman* and *Corinthian Columns*, are commonly fluted, or made with Flutes, or Hollows, running along the Body of the *Column* from the *Base* to the *Capital*.

Flyers, are Stairs made of an Oblong Square, whose fore and back Sides stand parallel to each other; and so are their Ends: The Second of these Flyers stand parallel behind the First; the Third behind the Second, and so of the Rest: If one Flight carries them not to the intended or required Height, then there is a broad Half-pace, from whence they begin to fly again, as the first.

Foliage, in *Architecture*, and *Sculpture*, is a Work wrought in Branches and Leaves.

Foot-Pace, or, as some call it, Half-pace, is a Part of a Pair of Stairs, whereon, after four, six or more Steps, you arrive to a broad Place, where you may take two or three Paces before you ascend another Step, thereby to ease the Legs in ascending the Rest of the Steps.

Foundation, the lowest Part of a Building, generally laid under Ground, upon which the Walls of the Superstructure are raised. This Word is also sometimes taken for publick Buildings erected for pious Uses.

Fountain, an artificial Spring of (or Well to contain) Water in a Garden; whither the Water is brought in Pipes of Lead, *&c.* and commonly made to spout out of the Mouths or other Parts of Images.

Framing of a House, is the Carcase, Flooring, Partitioning, Roofing, Ceiling, Beams, Aslering, *&c.* and indeed all that is done by the Carpenter.

Friese, or *Frize*, a large flat Member, that separates the *Architrave* from the *Cornice*. See its Etymology under the Word *Zophorus*.

Fresco, a way of Painting or Plaistering (or rather both) upon Walls, to endure the Weather, and representing Birds, Beasts, Herbs, Fruits, *&c.* in Relief.

Frett-Work, a plain Bordering round Ceilings, Picture-frames, *&c.* being made with divers Fillets, or Bands, and affording a great Viriety of Figures, by their Turnings.

Frigeratory, a Place to make or keep Things cool in.

Front, or *Frontispiece*, the Face or fore Side of a House, See *Portail*.

Frowey, Timber is said to be Frowey, when it is evenly tempered all the Way, and works freely without tearing.

Funnels of *Chimnies*, is the Shaft or smallest Part of them, where they are gathered into their least Dimensions upwards.

Furrings, among Workmen, is the making good of the Rafters Feet in the *Cornice*, *i. e.* when Rafters are cut with a Knee. These Furrings, are Pieces that go strait along with the Rafter, from the Top of the Knee to the Cornice; also, when Rafters are rotten, or sunk hollow in the Middle, and Pieces cut thickest in the Middle, and to a point at each End, are nailed upon them to make them strait again; the putting on of these Pieces is called Furring the Rafters, and those Pieces so put on, are called Furrings. The same Term is used for Joists, which being by Time sunk hollow in the Middle, are furred up strait.

Fust, from the *Latin Fustis*, a Club, signifies the Trunk, or Shaft of a *Column*, being that Part comprehended between the *Base* and the *Capital*.

G A

GABLE-END, in *Architecture*, the Gable-end of a House, is the upright triangular End of the Roof.

Gain, the bevelling Shoulder of the Joist, or other Stuff is said to gain by being longer.

Galleries, are long narrow Rooms, made on the Sides or Fronts of Houses; they serve for walking, eating, and other Divertisements.

Gard-Manger, from the *French*, a Store-house, or Room, to set Meal in.

Gavel, a Word used by some, by which they mean the same as the Gable.

Girding-Beams, is used by some Workmen, to signify the same Thing.

Girders, are some of the largest Pieces of Timber in a Floor, the Ends of them are, for the most Part, fram'd into Summers, or Breast-summers, and the Joists are framed in at one or both Ends of the Girders.

Glass, a transparent Body made by Art, of Flints, Sand and Ashes, and of this there are many Sorts, as Crown Glass, *French* or *Normandy* Glass, *German* Glass, *Newcastle* Glass, *Bristol* Glass, *Look* Glass, and *Jealous* Glass, which last is of that Nature, that it cannot be seen thro' yet admits of the Light thro' it.

Gothic Architecture, is that which is far removed from the Manner and Proportions of the *Antique*, having its Ornaments wild and chimerical, and its Profiles incorrect.

Gradatory, is derived from the *Latin*, is used to signify a Place to which we go up by Steps; particularly, an Ascent from the Cloister, to the Choir in some Churches.

Grainery, a Place to lay up Corn in.

Grange, a *French* Word, signifying a Building, which hath Barns, Stables, Stalls, and other necessary Places for Husbandry.

Ground-Plat, or *Plot*, a Piece of Ground which a Building is to be erected upon.

Groove, a Term used by the Joiners to signify the Channels that are made by their Plough in the Edge of a Moulding, or Stile, or Rail, *&c.* to put their Pannels in, in wainscotting.

Guttering, in Carpentry, is the Boarding, and Bearers to lay the Lead on, in the Fronts or Middle of the Roof.

Gutter-Tyles, are in the Form as they appear at a Distance, a Kind of a Triangle, having one Side convex, but this is whilst they are flat and plain before they are bent fit for Use.

H A

HAIR, the Hair here mentioned, is Bullocks-hair, such as is used in Mortar for Plaister.

Hangs-Over, Vide *Batter*.

Headers, a Term among Bricklayers, when Bricks are laid End-ways in a Wall, but when Length-ways, they call them *Stretchers*.

Heads, a Term used by Bricklayers, by which they mean half a Tile in Length; but to the full Breadth of a Tile, these they use to lay at the End of a Roof.

Healing, by this Word is understood the covering of the Roof of any Building, which is of various Kinds, *viz.* 1. Lead, 2. Tiles, 3. Slate, 4. Horsham Stone, 5. Shingles, 6. Reed, 7. Straw.

Heel, an inverted Ogee.

Helix, or *Urilla*, is a little Voluta Caulicole, or Stalk under the Flower of the *Corinthian Capital*.

Hinges, are those necessary Apendages, by which all Doors, all Lids of Boxes, Chests and Trunks, *&c.* make their Motion, either of opening, shutting or folding.

Hips, are those Pieces of Timber, which are at the Corners of a Roof, they are a great deal longer than the Rafters, by Reason of their oblique Position; and they are placed not with a right or square Angle, but a very oblique One; and, by consequence, they are not (or at least ought not) to be square at any Angle (as Rafters are) but bevel at every one of them; and which is yet more, as Rafters have but four Plains, these commonly have five: They are by Country Workmen usually called Corners; and some call them principal Rafters; and others Sleepers; the Truth is, Hips and Sleepers are almost the same; only the Sleepers lie in Vallies, and join at the Top with the Hips; but those Surfaces or Plains, which make the Back of the Hip, are the under Side of the Sleeper.

Hollow, a Term in *Architecture*, by which is meant a concave Moulding, being about a Quadrant of a Circle; by some it is called a *Casement*, by others, an *Abacus*.

Horsham Stone, is a Kind of a thin broad Slate, of a greyish Colour, much used in some Parts of *Sussex*, not only to heal or cover Churches and Chancels, but some great Houses also.

House, a Habitation or Place built with Conveniencies to shelter a Man's Person and Goods from the Inclemencies of the Weather, and the Injuries of ill disposed Persons.

Housing, a Term used by some Bricklayers, for when a Tile or Brick is warped, or cast crooked, or hollow in burning, they then say, *such a Brick*, or *Tile*, is Housing. Tiles are apt to housing or hollow on the struck Side (or that which was upper-

most in the Mould) and Bricks on the contrary Side.

Hyperthyron, a *Greek* Word, signifying the Lintel, or Cap-piece of a Door-case

I A

JAUMBS, Door-posts; also the upright Posts at the Ends of the Window-frames, and Chimnies, are so called. *Jaumbs* is a *French* Word, and signifies a Leg.

Ichnography, a Description; or Draught of the Platform or Ground-work of a House or other Building.

Impost, is a Term in *Architecture*, which I understand to be the Capitals of Pilasters, that support Arches. It comes from the *Italian Imposto*, surcharged or burdened with, or laid upon; take it either way, the name expresses the Thing.

Indigo, will grind very fine, and lie with a good Body; and is much used in Painting, &c.

Intercolumniation, is the Space between two Columns, which in the *Doric Order*, is regulated according to the Distribution of Ornaments in the *Frize*; but in the other *Orders*, according to *Vitruvius*, is of five different Kinds, *viz. Picnostyle, Sistyle, Eustyle, Diastyle*, and *Arcostle*. This the *Latins* express by their Word *Intercolumnium*.

Interduces, in *Architecture*, are those smaller Pieces of Timber that lie horizontally betwixt the Summers, or betwixt them and the Sill, or Raising.

Joists, in *Architecture*, are those Pieces of Timber framed into the Girders and Summers, on which the Boards of the Floors are laid.

Juffers, a Term used by some Carpenters, for Stuff about four or five Inches square, and of several Lengths. Also Quarters.

K E

KERE, the sawn away Slit in a Piece of Timber, or Board, the Way made by the Saw is called a *Kerf*.

Knee, a Piece of Timber cut crooked with an Angle, is called a *Knee-piece*, or *Knee-rafter*.

L A

LABORATORY. See *Elaboratory*.

Lathes, for Building, are long, thin and narrow Slips of Wood used in tyling or cielings, and are of three Sorts, *viz.* Heart of Oak, Sap-Lathes, and Deal-Lathes.

Lead, is a Material used in Buildings for Flats, Gutters, Pipes, Cisterns, Sinks, &c. and is well known, so needs no Description.

Lintels, (in Stone or Brick Buildings) are the Pieces of Timber that lie horizontally over the Tops of Doors and of Windows

List, and *Listalla*, is a little square Moulding, serving to crown or accompany a Larger, or on Occasion, to separate the Fluteings of a *Column*. It is sometimes called a Fillet, and sometimes a Square; it comes from the *Italian* Word, *Lista*, any Kind of List or Selvage; also a Board is said to be *listed*, when the Sap on the Edges, is sawn away.

Lobby, as *Anti-chamber*.

M A

MANTLE, in *Architecture*, is the Head-piece on the Jaumbs of a Chimney-piece, either of Stone, Wood, or the like.

Marble, is a Kind of Stone, extremely hard, firm, and solid, dug out of Pitts and Quarries; it takes a beautiful Polish, and is much used in Ornaments of fine Buildings, as *Columns*, *Statues*, *Chimney-pieces*, &c. Of this Stone, there are many Kinds, *viz. black and white Marble, purple Marble, Egyptian Marble, black and yellow Marble, Statuary Marble*, &c.

Masonry, is a Branch of *Architecture*, consisting in the Art of Hewing, Squaring and Moulding of Stones for the Use of Building, or may be understood, for the assembling and joining Stones together with Mortar.

Membratto, a *Pilaster*, that bears up an Arch.

Metops, is the square Interval between the Triglyphs of the *Doric Frize*, which, among the *Ancients*, used to be adorned with Heads of Beasts, Vases, Basons, and other Instruments used in sacrificing.

The Beauty of these Metops consists in their Regularity; that is, in their being perfect Squares; and yet when they are really Square, they appear to be less in Height than in Breadth, which is owing to the Projecture of the little Bandelet, wherein they terminate underneath, that hides a small Part of their Height; for this Reason, Mr. *Le Clerc* is for making the Metops a Minute or two more in Height than in Breadth; being of Opinion, they ought rather to appear Square, without being so, than really be Square without appearing so.

Minute, is usually the 60th Part of a *Module*.

Mitchels, Purbec Stones for paving, pick'd all of a Size, from fifteen Inches square to two Foot.

Model, in *Architecture*, is particularly used in building for a *Pattern* made in Wood, Stone, Clay, or other Matter; with all its Parts and Proportions in small, in order to give an *Idea* of the Effect it will have in large, when executed.

Modern, this Word in its genuine Meaning, is only applicable to such *Architecture*, as partakes partly of the *Gothic*, retaining somewhat of its Delicacy and Solidity; and partly of the *Antique*, whence it borrows Members and Ornaments without any Proportion or Judgment.

Module, a Measure made Use of to regulate the Proportions of the several Members of *Columns*: In all the *Orders*, it is the whole Diameter: A *Module* is commonly supposed to be divided into sixty equal Parts, called Minutes; *Module* comes from the *Latin Modulus*.

Modillions, in *Italian Modiglioni* (a Sort of *Cantalivers*) are little inverted Consoles under the Soffit or Bottom of the Drip in the *Ionic*, *Composite*, and *Corinthian Cornices*, and ought to correspond to the Middle of the *Columns*. These are particularly affected in the *Corinthian Order*, where they are always enriched with carved Work. In the *Ionic* and *Composite* they are simple, having seldom any Ornament, excepting sometimes a single Leaf underneath; In *Lat.* they are called *Mutuli*.

Moresk-work, a Kind of *Antique-work*, in Painting and Carving, after the Manner of the *Moors* (whence it has its Name) consisting of several *Grotesco's*, wherein there is no perfect Figure, either of Man or other Animals, and wherein there is a wild Resemblance of Birds, Beasts, Trees, &c. intermingled.

Mortar, in *Architecture*, is a Preparation of Lime and Sand mixt with Water, serving as Cement, and is used by Masons and Bricklayers in Building; and to a Rod of Brick-work is required 1 hundred of Lime, and two Loads of Sand; and for Tyling, four Bushels of Lime, and six or eight Bushels of Sand, will be sufficient for laying a thousand Tyles, which is about a Square and a Half; so that a Square of Tyling will require about 2 ½ Bushels of Lime, and about 5 Bushels of Sand.

Mosaick, or *Mosaical-work*, is a curious Kind of Work consisting of small inlaid Pebbles, Cockles, and Shells of different Colours; and (of late) likewise with Pieces of Glass figured at Pleasure.

Mouldings, under this Name, are comprehended all those

those Jettings, or Projectures beyond the Naked of a Wall, Column, &c. which only serve for Ornament, whether they be square, strait, round, or crooked. Of these there are seven Kinds, more considerable than the Rest, *viz.* the *Doucine*, or *Cima recta*; the *Talon*, or *Heel*; the *Ovolo*, or *Quarter-round*; the *Plinth*, the *Astragal*, the *Denticle*, and the *Cavetto*.

Munions, in Carpentry, are the short upright Posts, that divide the several Lights in a Window-frame.

Muniment, Room, a Place for the keeping of Seals, Charters, Evidences, &c.

N A

NAILS, in Building are small Mettaline Members well known, but are very numerous in their Sorts, as has been before shewn in this Treatise; the Number required for Lathing, is about 500 to a Bundle of 5 Foot Laths, and 600 to a Bundle of 4 Foot Laths, at 6 Score to the Hundred, and for Flooring is required 200 to a Square. Nails are made tough by heating them in a Fire-shovel, or the like, and putting some Tallow or Grease on them.

Newel, the upright Post that a Pair of winding Stairs turns about.

Niches, the hollow Places in a Wall where Statues are set.

Nofeing, are Parts of the Sides of a Marble Chimney-piece; also the Edges or front Parts of Steps, or at the Foot of a Cove, &c.

O B.

OBELISK, is a quadrangular Piramid, very tall and slender, raised in a publick Place to serve as a Monument of some memorable Action.

Og, *Ogee*, or *Orgive*, a Sort of Moulding in *Architecture*, consisting of a Round and a Hollow, like an S.

Oblique Glasses, are those that are ground either concave or convex, so as to collect or disperse the Rays of Light, by Means of which *Vision* is improved, and the Eye also strengthened and preserved.

Oratory, in *Architecture*, is a Closet, or a small Apartment near a Bed-chamber, furnished with a little Altar, or Image for private Devotion, amongst the *Romanists*.

Orders, in *Architecture*, are the different Forms and Proportions of *Columns*, &c. there are five *Orders*, commonly reckoned in *Architecture*, *viz.* the *Tuscan*, *Doric*, *Ionic*, *Composite*, and *Corinthian*.

Orlo, the Plinth or Square under the *Base* of a *Column*, or under the Base of its Pedestal.

Ornaments, by which is understood, all the Sculpture, or carved Work, wherewith a Piece of *Architecture* is enriched.

Orthography, in *Architecture*, signifies the Front or any other upright Side of a House, or the Draught on Paper, of those Parts of the House.

Ovolo, as *Echinus*.

P A

PAINTING, a Work in Building well known; for the Particulars of which, see the foregoing *Treatise* on *Ditto*.

Palisade, or *Palisado*, is an open Fence either of Wood or Iron, for the displaying of a Prospect of a House, Garden, &c. or in Fortification.

Palification, a Term in *Architecture*, signifying the Piling of the Ground-work, or the strengthening the same, with Piles of Timber driven into the Ground, when they build upon a moist and marshy Soil.

Pannel, in Joinery is a square Piece of thin Wainscot, sometimes carved, and framed, or grooved in between thicker Pieces. In Masonry is one of the Faces of a hewn Stone.

Pantheon, in *Architecture*, is a Temple, or Church of a circular Form, dedicated to all the *Gods*, or all the *Saints*.

Pantry, a Room for the keeping of Victuals, a Store-room.

Parallel-Rular, is an Instrument made of Wood and Brass for drawing of parallel Lines.

Parapet, from the *Italian Parapetto*, a Save-breast, is a little Wall, or sometimes a Rail, serving either as a Rest for the Arm, or as an Inclosure about a Quay, Bridge, Terrass, &c.

Parastatæ, Pilasters which stand alone, not adjoining to the Wall, and which the *French* call *Isolces*, or *Insulate* from *Insula* an Island as I take it.

Pargetting, in *Architecture*, signifies the plaistering of Chimney Funnels, sometimes it is used to signify the Plaister itself.

Parlour, a fair lower Room, designed for the Entertainment of Company.

Passage, an Entry or narrow Place, serving for a thorough Fare into other Rooms.

Pavement, a Lay of Stone, Brick, or other Matter serving to strengthen the Ground of diverse Streets, or other Places, for the more commodious walking thereon.

Pediment, in *French*, *Fronton*, from the *Latin Frons*, the Forehead, is an Ornament that Crowns the Ordinance, finishes the Fronts of Buildings, and serves as a Decoration over *Gates*, *Windows*, *Niches*, &c. It is ordinarily of a triangular Form; but sometimes makes an Arch of a Circle. *Vitruvius* calls it *Fastigium*.

Pedestal, is a square Body, with a *Base* and a *Cornice*, serving as a Foot for the *Columns* to stand upon, and having according to *Vignole* one Third of the Height of its *Column*, it is varied in the different *Orders*.

Pediments, are the Crowning frequently seen over *Gates*, *Doors*, &c. and sometimes over entire *Orders* of *Architecture*. The *Ridges* of *Houses* were what gave *Architects* the first *Idea* of this noble Part.

Pentadoron, a Kind of a Brick so called.

Perquetting, *a Floor* laid or composed of divers small Figures, as *Squares*, *Rhombus's*, &c.

Periptere, in the ancient *Architecture*, is a Building encompassed round with *Columns*. The Word comes from the *Greek Peri* about, and *Pteron* a Wing.

Perrons, are Steps raised before the Doors of great Houses.

Persian Order, is that which has Figures of *Persian Slaves*, to support the Entablement instead of *Columns*, as the *Cariatic Order*, has the *Figures* of Women, serving for the same Purpose. The former *Columns* are usually like robust Men with long Beards, and *Figures* are more fit for an unhappy Slavery, than those of Women. The Character of Slavery is expressed in these *Figures*, either by tying their Hands before, or else behind their Backs. *Columns* of this Kind, may very properly be used in a Gallery of Arms, &c. Princes Palaces, in which Case, they may be made *Gigantic*, and their *Entablature Doric*.

Piazza, in *Architecture*, commonly called *Piache*, an *Italian* Name for a *Portico*; it signifies a broad open Place or Square, whence it became applied to *Walks* or *Portico's* of *Pillars* around them, like those of *Covent Garden*, &c.

Piedroit, in *Architecture*, is a square Pillar, that is partly within the Wall.

Pillar is a Kind of a round *Column* disengaged from any Wall, and made without any determinate Proportion, being always either too massive, or too slender; such are the *Pillars* which support the Walls of *Gothic* Buildings, in *Latin* they are called *Pilæ*.

Pilasters, in *Architecture*, are a Kind of half square Pillars (standing against the Wall) with *Bases* and *Capitals*, as *Columns* have.

Pitch,

Pitch, by this Term, *Architects* understand the Angle, a Gable-end (and consequently the whole Roof of a Building) is set to.

Platbands, the Lists, or Fillets, being the Flutings of the *Ionic*, *Composite* and *Corinthian Columns*. They are each in Breadth a Quarter of the Flute. *Platbands* are also a square Moulding set at the End of an *Architrave* of the *Doric Order*, *Platband*, *Perrault* says, is a square Moulding, having less Projecture than Height.

Platform, this Word, in *Architecture*, is sometimes used to signify the *Ichnography*, or *Draught* of the Ground-plot of a House; but more commonly for a broad, smooth, and open Walk upon the Top of any Building; it is also a Row of Beams, which support the Timber-work of any Roof, and lie upon the Top of a Wall where the *Entablature* ought to be raised.

Platfond, a *French* Word for the Ceiling or Roof of a Chamber or other Room, &c. the same as Soffit.

Plastique, or *Plastic Art*, is a Branch of *Architecture* that is not only comprehended under *Sculpture*; but is indeed very *Sculpture* it self; but with this Difference, that the Plaisterer, by his *Plastique Art*, makes Figures by Addition; but the Carver by Subtraction.

Plinth, is derived from the *Greek*, *Plinthos*, a square Brick, and is in *Architecture*, a square Piece, or Table, under the Mouldings of the Bases of *Columns* and *Pedestals*.

Plumbery, an Art belonging to *Architecture*, it being the Art of working in Lead.

Porphyry, a fine reddish Marble, streaked with divers Colours. *Pliny* says, this kind of Marble comes out of *Egypt*, where there are large Quarries of it.

Portland Stone, is much used in Building, and by much softer and whiter than *Purbec*.

Portal, an ancient Term in *Architecture*, it was used to signify a little square Corner of a Room, shifting off from the Rest of the Room by the Wainscot. The Word comes from the *French Portal*, a Gate or Entrance, becaufe thro' it they enter into the Room.

Portails, the Decoration of the Face, or Front of a Church, called also *Frontis-piece*.

Portico, a Kind of Gallery raised upon Arches, where People walk under Shelter. It has sometimes a Soffit, or Ceiling, but is more commonly vaulted. Also the Front of a Church, &c. where *Columns* are detached from the Building, as the *west* End of St. *Martin's*, St. *Paul's*, *Covent Garden*, &c.

Prict Posts, and *Stiles*, among Carpenters, are such as come in between Principals.

Profile, in *Architecture*, is a Draught representing the Breadth, Depth, and Height of a Fortification, or Building, but not the Length; which properly belongs to a Plan, or Ground-plot, so that it is in a Manner the same with the Prospect of a Place, or Building, view'd Sideways, and expressed according to the Rules of *Perspective* in such a Case.

Project, all Mouldings, &c are said to project, when they jutt out, or are beyond the Superficies.

Proportion, is the Justness of the Members in each Part of the Building, and the Relation they bear to the Whole.

Pudlays, Pieces of Stuff to do the Office of Leavers or Hand-spikes.

Pulvinata, a Frize swelling like a Pillow.

Punchins, short Pieces of Timber placed under some considerable Weight to support it. They commonly stand right between the Posts; they are shorter and slighter, than either their principal Posts or prict Posts; those that stand on each Side of a Door, are called Door *Punchins*.

Purlins, those Pieces of Timber that lie a-cross the Rafters on the Inside to keep them from sinking in, in the Middle of their Length.

Purbec-Stone, is a hard greyish Stone almost like *Sussex Petties*, they are used for Pavements.

Putlogs, Pieces of Timber, or short Poles (about seven Feet long) used by Masons and Bricklayers in building of Scaffolds to work on. The *Putlogs* are these Pieces which lie horizontal to the Building, one End lying into it, and the other End resting upon the Ledgers; which are those Pieces that lie parallel to the Side of the Building.

Pycnostyle, this Term is used, when the *Columns* are ranged so close to one another, that the Intercolumination does not exceed 1 Diameter.

Pyramid, from the *Greek*, *Pyr*, *Fire*, or *Flame*, this being pointed like that. It is a solid Body, whose Base is either Square, Triangular, or Polygonal, and which from the Base diminishes continually to its Vertex, or Top.

Pyleing, the Ground to Foundations.

Q U

QUARRY, (of Stone) a Place whence Stones are dug out, or (of Glass) a Piece of Glass cut in a Diamond Form. Quarries of Glass are of two Kinds, to wit, Square and Long; and these again, are of different Sizes, as 8's, 10's, 12's, 15's, 18's and 20's; that is, 8 Quarries make a Foot of Glass, and so does 10 Quarries of 10's, 12 of 12's, &c. But all Quarries, of what Size soever, are cut of one Sort of Angle, for the square Quaries, and another for the long Quarries; the acute Angle of the square Quarries being 77 Degrees 19 Minutes, and the acute Angle of the long Quarries 67 Degrees 22 Minutes.

Quarters, in *Architecture*, are all those slight upright Pieces between the *Punchins* and *Posts*, which serve to lath upon.

Quarter-round, by this Name the Workmen call any Moulding, whose Contour is a Circle, or approaching to a Circle; using this Term, wherever the *Architects* use that of Eggs, or Ovolo.

Quirk, in *Architecture*, signifies a Piece taken out of any regular Ground-plot, or Floor, as if the Ground-plot were a Square or an Oblong, and a Piece taken out of one Corner of it, for a Court, or Yard, that Piece taken out is called a *Quirk*.

Quoins, the Corners of Brick, or Stone-walls; also the Stones in the Angles of Buildings, whether plain, rustic, or otherwise.

Quadrels, a Sort of artificial Stones, (so called from their Form, they being Square) made of a chalky, whitish, and pliable Earth, and dried in the Shade.

R A

RAFTERS are those Pieces of Timber that (standing by Pairs on the rising) meet in an Angle at the Top, and compose the Roof of a Building.

Raiser, a Board edge ways under the fore Side of a Step.

Raising-pieces, are Pieces that lie under the Beams upon Brick, or Timber by the Side of a House.

Range, the Side of any Work that runs strait, without breaking in Angles, is said to range; thus, the Rails of one strait Side of wainscotting is said to range.

Repository, a Store-house, or Place to keep Things in; more particularly by *Architects*; 'tis used to signify such Places as are built for the laying up of Rarities, either in Painting or other Arts.

Return, the Side that falls away from the Foreside of any strait Work, is called the *Return*.

Ridge, the Meeting of the Rafters on the Top of the House, is called the *Ridge*.

Roof, the covering of a House; but the Word is used

used in Carpentry for the Timber Work of the covering.

Rose, is an Ornament, cut in the Spaces, which are between the *Modillions* under the *Plat-Fonds* of *Cornices*, and in the Middle of each Face of the *Abacus* in the *Composite* and *Corinthian Capitals*.

Rustic, a Manner of Building entirely rude, rather in Imitation of Nature, than according to the Rules of Art.

S A

SAGITTA, in *Italian Sagitta* (an Arrow) signifies what we call the Key-piece of an Arch.

Salon, is a Kind of Hall in the Middle of a House, or at the Head of a Gallery, or a large Apartment, which ought to have a Symmetry on all Sides, and as its Height usually takes in two Stories with two Rows of Windows, the Bottom of its Plat-fond ought to be arched, as is practised in some of the Palaces in *Italy*.

Saffeta, or *Sofita*, or *Sofit*, an *Italian* Word (from *Subfixum* in *Latin*) a Sort of Ceiling. In ordinary Buildings, it is taken for the Boards over the Tops of Windows, opposite to the Window-boards at the Bottom. In great *Edifices*, it signifies the Ceiling, or wainscotting of any Apartment formed by cross Beams, or flying Cornices, and having the square Pannels of its Compartments inriched with *Sculpture*, *Painting* and *Gilding*, as we may observe in the *Basiliques* and *Palaces* of *Italy*.

Sand, is a fine, hard, gravelly Earth of great Use in Building and other Works. There are three Sorts of *Sand*, distinguished by the Places whence they are drawn, *viz.* Pit, River, and Sea *Sand*, and is a principal Ingredient in making Mortar.

Sawing, the Application of the saw, in dividing of Timber, &c. into Boards.

Scantling, the Size that any Timber is designed to be cut to.

Sconography, from the *Greek Skone*, a Tent; or Tabernacle; and *Grapho*, to draw, or describe; is a Model, or Description of the Front and Sides of a House, or the Art of rightly contriving Draughts in *Architecture*.

Sima-Reversa, an Ogee with the Hollow downward. *Vide* Ogee.

Scotia, a Member of *Architecture*, it is hollow like a Semi-circle. It is particularly placed in the Base of *Columns*, between the *Torus* and the *Astragal*; and sometime it is put under the Drip in the *Cornice* of the *Doric Order*. *Scotia* from the *Greek*, *Skotia* Darkness, signifies, says Mr. *Perrault* a hollow obscure Moulding between the *Torus's* of the *Base* of a *Column*.

Scribe, a Term used by Carpentes and Joiners, when they are to fit one Side of a Piece of Stuff against the Side of some other Piece of Stuff, and the Side of the Piece they are to fit it to is not regular.

Sculpture, the *Art* of carving in Wood or Stone.

Sewers, in *Architecture*, are Conduits or Conveyances for the Soilage and Filth of a House.

Sells, in *Architecture*, are of two Kinds, *viz.* Ground Sells, which are the lowest Pieces of Timber in a Timber Building, on which the whole Superstructure is erected. And Window *Sells*, commonly called Window *Soils*, which are the Bottom-pieces in a Window-frame.

Shaky, or *Shaken*, such Stuff as is cracked, either with the Heat of the Sun, or the Drought of the Wind, is called *Shaky* or *shaken Stuff*.

Shingles, are small Pieces of Wood, or quarter'd Oak-boards, sawed to a certain *Scantling*; but they are more usually cleft to about an Inch thick at one End, and made like Wedges, about four or five Inches broad, and eight or nine, and in some Places 12 Inches long. They are used to cover Houses; but more commonly Churches and Steeples with, instead of Tiles or Slates.

Shingling, the laying on of *Shingles*.

Shoulder, among Carpenters is the Sides, or Butments of a Tenon.

Skirting Boards, the narrow Boards fitted round the Under-side of a Wainscot against the Floor.

Slabs, the outside sappy Planks, or Boards sawn off from the Sides of Timber; also the Foot-pace to a Chimney-piece is called a *Slab*.

Slating, is the covering of Houses with *Slate*.

Sleeper, in a Roof, is the *Oblique* Rafter that lies in the Gutter.

Sluices, Vents or Drains for Water.

Solive, a *French* Word, signifies a Joist, Rafter, or Piece of Wood, either slit or sawed, wherewith the Builders lay their Ceilings.

Spira, is properly *Latin* for the Fold of a Serpent laid at rest, or the Coil of a Cable-rope, &c. in *Architecture*, it is sometimes used for the Base of a *Column*; this making a Figure not unlike those.

Square, a certain Measure made use of in measuring several *Artificers* Works, consisting of 100 superficial Feet.

Stairs, are of various Sorts; as Strait-Flyers, Square-Flyers, Triangular-Flyers, *French*-Flyers, Winding-Flyers or Stairs, and mixt Stairs. See Plate XXXII. Lib. II.

Statues, are imbossed Figures, either in Stone, Metal, or Wood; representing some Person distinguished by his Birth and Merit, &c. and either serving as an Ornament of a Palace, or exposed in some publick Place, to perpetuate the Memory of the Person it is intended to represent.

Stiles, in Joinery, the upright Pieces that go from the Bottom to the Top, in any Wainscot or the like.

Stillatory, the Room that a Still or Limbeck, is set up in, for distilling strong Waters, &c.

Stylobatum, the Body of the Pedestal of any *Column*.

Stone, is a hard solid mineral Body, neither fusible nor malleable, formed in Succession of Time in the Body of the Earth.

Stove, a hot House for preserving *Exotic* Plants; also a Kitchen Term for a Sort of Furnice, where they prepare *Ragouts*, &c.

Strait, a Term used by Bricklayers, it is half, (or more or less than half) a Tile in Breadth; and the whole Length; they are commonly used at the Gable-Ends, where they are laid at every Course to cause the Tiles to break Joint, as they phrase it; that is, that the Joints of one Course may not answer exactly to the Joints of the next Course, either above or below it.

Strings, are those Timbers which support the Stops of wooden Stairs.

Stuff, the Wood that Joiners work upon, they call in general *Stuff*.

Stylobatæ, the same as Pedestals; the *Greek* Word from *Stylos*, a Pillar, and *Basis*, the Base or Foot thereof.

Summer-tree, a Beam, full of Mortises, for the Ends of Joists to lie in.

Symmetry, is the Comparison which runs between the Parts of a Building and the Whole.

Systole, is that Manner of placing *Columns* where the Space between the two First consists of 2 Diameters, or Modules.

T A

TABERN, a Cellar.

Talon, the same as a Heel, a Moulding in *Architecture*.

Taper, all Sorts of Stuff, or Work, that is smaller at one End than the other, and diminishes gradually, from the biggest End, it is said to be taper.

Tarrau, or *Terrass*, an open Walk or Gallery, also a flat Roof on a House; likewise a Kind of a coarse Plaister, durable in the Weather.

Tassels,

Tassels, Pieces of Timber, that lie under the Ends of the Mantle-tree.

Tenon, a square End of a Piece of Timber fitted into a Mortise.

Tetradordon, a Kind of a Brick so call'd.

Thatching, is the Covering of the Roof of a House or Barn with Straw or Reed.

Theatre, is a publick Edifice or Place, wherein Plays or Shows are exhibited to the People, as in *Drury Lane*, *Covent-Garden*, or *Lincoln's-Inn-Fields Theatres*.

Thermes, or *Termes*, a *French* Word from *Terminus*, the *Roman* God of Boundaries, Land-Marks, which they used to represent in a human Figure, with half a Body, as if it proceeded out of a Sheath, or Case Those they fixt in the Earth as Land-marks. In *Architecture*, they serve as a Kind of a symbolical *Column*.

Through-lighted, Rooms are said to be *Thorough-lighted*, when Windows are at both Ends.

Tiles, in Building, are a Sort of thin artificial Stones, used in the Roofs of Houses, &c. but more properly they are a Kind of fat clayed Earth, moulded together, and dried and burnt in a Kiln. There are various Kinds of *Tiles*, known by several Names, as Plain, Thack, Ridge, Roof, Crease, Gutter, Pan, Crooked, Flemish, Corner, Hip, Dormar, Scallop, Astragal, Traverse, Paving, and *Dutch-Tiles*.

Timber, includes all Kinds of Woods, felled and season'd, or those Kinds of Trees, which, when so prepared, are made Use of in Building, by the Carpenter, Joiner, Turner, &c. and which chiefly are *Oak*, *Elm*, *Beech*, *Ash*, *Fir*, which is also called Deal; there is also *Wallnut-tree*, *Chesnut-tree*, *Poplar*, *Aspen*, *Alder*, *Lime-tree*, &c. but these are not accounted Timber.

Torus, a large round Moulding in the Bases of *Columns*, the Word comes from the *Latin*, *Torus*, a Bed; the Figure of this Moulding being not unlike that of the Side of a Quilt

Transom, the Piece that is fram'd a-cross, a double lighted Window.

Traverse, a Term in Joinery, signifying to plane a Board, or the like, a-cross the Grain.

Tryglyph, a Term in *Architecture*, the Word is originally *Greek*, and signifies a hollow Gravelling, like Furrows, or Gutters. In *Architecture*, *Triglyphs*, are those Kinds of Stops in the *Doric*, between the Metops.

Trim, when Workmen fit a Piece into other Work, they say, they trim in a Piece,

Trimmers, in *Architecture*, those Pieces of Timber framed to the Joists, against the Ways for Chimnies, and Well-holes for Stairs.

Trunk, from the *Latin*, *Truncus*, signifies the *Fust* or *Shaft* of a *Column*, and the Die of a *Pedestal*; and is also used for bringing down Water from the House Top.

Tusk, a bevel Shoulder made to strengthen the Tenon of the Joist which is let into the Girder.

V A

VALLEYS. the Gutters over the Sleepers in the Roof of a Building.

Vault, is a Piece of Masonry, arched without side, and supported in the Air by the artful placing of the Stones which form it, its principal Use being for a Cover, or Shelter Few Houses in modern Building are without them

Vestible, among the *Ancients* was a large open Place or Square before the Door, or at the Entry of a House, which they call *Atrium Populatum* and *Vestibulum*, being dedicated, as *Martinus* tells us, to the Goddess *Vesta*; whence he will have the Word derived, *i. e. Vestæ Stabulum*, it being usual for People to stop here, before they went within Doors.

Under-Pinning, by this Term is meant, the bringing it up with Stone or Brick under the Ground-sells of a Building,

Volute, from *Volvo*, to fold, is one of the principal Ornaments of the *Ionic* and *Composite Capitals*, representing a Kind of Bark, wreathed, or twisted into a spiral Scroll.

Urn, comes from the *Latin*, *Urna*, a Vessel to draw Water in, and signifies a low wide Vase, serving as a Crowning over Ballustrades, and as an Attribute to Rivers, River Gods, &c. in the Grotto's and Fountains in Gardens.

Voissoirs, the Stones that form the Arch, a *French* Word.

W A

WAINSCOT, the pannelled Work round about the Walls of a Room.

Wainscotting, the making and setting up of Wainscot.

Walling, the making of Walls of what Kind soever is called walling.

Wash-House, a Room to wash in.

Water-Table, in Stone, or Brick-walls is a Sort of Ledge, left out of the Wall, some 18 or 20 Inches, more or less above the Ground, at which Place the Thickness of the Wall is abated, or taken in, on each Side, the Thickness of a Brick, in Brick-walls, namely, 2 Inches; thereby leaving that Ledge or Jutt.

Weather-Boarding, a Term in Carpentry, signifying the Nailing up Boards against Quarters.

Well Holes, the Space left in a Floor for the Stairs to come up through.

Weather-Flying, is the Tyling the upright Sides of Houses.

Withyes, these are used by Thatchers to bind their Thatching-Rods to the Rafters.

X Y

XYSTOS, among the Ancient *Greeks*, was a Portico of common Length, either cover'd, or open, wherein the *Athleta* used to exercise themselves, in running Races and Wrestling. The Word is derived from *Xythin*, to polish.

Z O

ZOCLE, the same as Plinth, it signifies a Sort of wooden Shoes, or Sandals, from the *Latin*, *Soccus*, Buskins wore by the ancient *Actors*. In *Architecture*, 'tis a square Body, less in Height than Breadth, and placed under the Moulding, of the *Bases* of *Pedestals*.

Zophorus, the same as Frize, a large flat Member, which separates the *Architrave* from the *Cornice*. It is derived from the *Greek Zoophoros* (i. e.) *Animal-bearing*.

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FINIS.

ERRATA.

PREFACE, line 27. *for* which I make, *read* which make; *Advertiſement, l.* 9. *for* our Buildings, *r.* our old Buildings; *Page* 11. *l.* 30. *for* $\frac{1}{10}$ *r.* $\frac{1}{20}$ *p.* 33. *l.* 23. *for* deſcribe, *r.* deſcribed; *p.* 50. *l.* 23. *for* include, *r.* conclude; *p.* 56. *l.* 16. *for* for if the, *r.* for the; *l.* 38. *for* Frize, *r.* Trees; *p.* 65. *l.* 35. *for* Checks, *r.* Cheeks; *p.* 68. *l.* 17. *for* moſt, *r.* more; *p.* 80. *l.* 33. *for* Colomns, *r.* Columns; *p.* 88. *l.* 6. *for* equal in, *r.* equal to; *p.* 97. *l.* 14. *and* 15. *dele* Yard. *Book III. p.* 5. *l.* 15. *for* Clumbs, *r.* Clubs.